QUALITY OF CARE IN THE NEW MEXICO MEDICAID PROGRAM (1971-1975)

The Effect of the New Mexico Experimental Medical Care Review Organization on the Use of Antibiotics for Common Infectious Diseases

PREPARED FOR THE U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Kathleen N. Lohr, Robert H. Brook, and Michael A. Kaufman
with the assistance of Bryant Mori, Caren J. Kamberg, and Larry Miller

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I. Overview of the New Mexico Peer Review System

In 1971 a peer review system designed both to improve the quality of care and to control the use and costs of medical care for Medicaid eligibles became operational in New Mexico. As the New Mexico Experimental Medical Care Review Organization (EMCRO), it functioned for 4 years, reviewing all claims for payment for services rendered for inpatient and ambulatory care for the entire Medicaid population. This monograph describes the patterns of care delivered by physicians participating in this Medicaid program to patients with common respiratory or other infectious diseases, and highlights certain changes in the therapy and management of such conditions that were brought about in part by EMCRO activities. In particular, we focus on the ways in which use of injectable drugs shifted over time and on the ways that entire episodes of respiratory illnesses were managed with respect to injectable and oral antibiotics, laboratory tests and physician visits.

The investigations reported here were of several types: 1) overall changes in use of injections by pharmacologic type of drug; 2) differences in injection use by type of physician; 3) differences in injection use by physician type for selected ambulatory conditions; and 4) differences in quality of care for entire episodes of illness by physician type. Chapters II, III, V, and VI cover these topics respectively; Chapter IV gives a review of relevant literature on the use of diagnostic tests and antibiotics, with particular attention given to the conditions studied here.

The findings from this research have at least 2 unique elements. First, little has been published about the ways in which different types of physicians in private practice choose to treat common illnesses. What has appeared tends to focus on either small numbers of patients or physicians or on a single institution's practices; except for research on the Tennessee Medicaid population, little if any recent literature documents patterns of medical practice for large population groups, especially with respect to specific diagnoses. Thus, even the descriptive, "epidemiologic" findings reported here are important for health services researchers, planners and policymakers for questions involving, for example, quality of care for common acute illnesses, service-specific reimbursement policies for care financed by federal programs, undergraduate medical and continuing education programs, and incentives for improved ways of organizing medical practice.

Second, our previous evaluations of the New Mexico EMCRO focused strictly on rates of change in injectable drug use, with no control for changes in diagnostic mix. Moreover, certain questions remained—in particular, whether the apparent effect of the EMCRO in reducing injection use brought about undesirable reactions among Medicaid physicians (such as, for example, unwarranted increases in use of oral medications). In effect, that evaluation was incomplete. Thus, the results presented here, especially those dealing with specific diagnoses and with whole episodes of care, make the evaluation aspects of this work more comprehensive and more valid.

In addition, many aspects of the PSRO program have been modeled on the features of the EMCRO program; in particular, incorporation of certain parts of the New Mexico EMCRO's ambulatory review system into future PSROs has been suggested. For these reasons, evaluation of the New Mexico EMCRO can indicate to policymakers the abilities and limitations of such organizations to improve or at least maintain the quality of medical care, especially in federally funded programs. Such evaluation can also highlight topics likely to be important to researchers with access to similar data bases.

The Medicaid-Eligible Population

The New Mexico Medicaid-eligible population included persons in 4 major medical aid categories: Aid to Families with Dependent Children (AFDC); Aid to the Permanently and Totally Disabled (APTD); Old Age Assistance (OAA); and Aid to the Needy Blind (ANB). Almost 72 per cent of all eligibles were in the AFDC category; apart from a very small number in ANB (0.05 per cent of the total population), the remainder were split almost evenly between OAA and APTD (14 and 15 per cent, respectively). More detailed descriptions of the eligible population are contained in Brook, Williams and Rolph.[8]

Four eligibility groups had been defined in previous evaluations according to the period of entitlement of care under the Medicaid program. Group I (people continuously enrolled for all 4 years) is the most important for the present study. Of all eligibles in the program, more than 40 per cent were in Group I and more than 25 per cent were in both Group I and AFDC. This AFDC-I population, numbering more than 21,000 persons, formed the cohort on which the episode-of-care analyses were carried out (see Chapter VI).

As might be expected from the high proportion of AFDC eligibles, almost 45 per cent of the eligible population were children (aged 14 or younger); another 29 per cent were between 15 and 44 years of age; 12 per cent were between ages 45 and 64; and 15 per cent were aged 65 years and older.

Women constituted almost 60 per cent of the eligible population. The eligible group was overwhelmingly white (more than 80 per cent); the next largest group was American Indians (11 per cent); blacks made up 5 per cent and other ethnic groups 4 per cent of the total population.

The total number of eligible-months over the 4 years was 4,056,897, for an average monthly count of Medicaid eligibles of 84,519. Changes in demographic characteristics of the eligible population over time (e.g., age distribution, race or sex) were very small and did not need to be controlled or adjusted for in this study.

The New Mexico EMCRO

The New Mexico peer review system was established in September 1971 and became an Experimental Medical Care Review Organization (EMCRO) in March 1972; through August 1975 (the time span of this evaluation), the EMCRO functioned much as present-day Professional Standards Review Organizations (PSROs).# The New Mexico EMCRO was formed as a 3-part organization—a fiscal intermediary component (The Dikewood Corporation), a peer review component (the New Mexico Foundation for Medical Care), and the State Department of Health and Social Services in New Mexico. From the outset, the New Mexico EMCRO undertook review of all medical care given to persons eligible for the Medicaid program. Both inpatient and ambulatory care were reviewed by means of a comprehensive, computerized system involving both clerical and professional (physician) reviewers. All services for which payment was sought were reviewed against administrative guidelines that covered elements such as patient eligibility and duplicate claims. Claims that did not pass administrative screening were not reviewed against quality-of-care guidelines.

For ambulatory care, the EMCRO developed a review system that facilitated assessment of the quality and necessity of

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# The historical background of quality-assurance organizations, such as Foundations for Medical Care, EMCROs and PSROs, can be found elsewhere,[6,7] as can descriptions of various PSRO programs.[7,24,25,28,29,35,74]

care for a variety of services. Special emphasis was given to type and frequency of injections (by diagnosis), type and frequency of laboratory tests, frequency and level of office visits, and the need for emergency room services. Guidelines for use of injections and office visits were related to diagnoses. Prescription drugs were *not* subjected to peer review. Detailed procedure codes were developed (e.g., for injections) to aid the review process; modifications to the California Relative Value Scale were used for coding ambulatory visits. At the beginning of its operations, the EMCRO used the HICDA-I (Hospital Adaptation of the International Classification of Diseases, Adapted for Use in the United States) to code diagnoses; in July 1974, it switched to HICDA-II.

Claims for ambulatory services (visits, injections, laboratory tests) could specify 1 or 2 diagnoses; incomplete claims lacking any diagnosis were returned to the physician for completion before either review or payment. The Dikewood Corporation meticulously coded and entered claims into the data base, using data-processing procedures that checked for coding errors and maximized the accuracy of the information. For example, errors in physician identification numbers could be caught and corrected at an early stage and discrepancies between information on hard-copy claims and computer-stored information could be identified and corrective steps taken.

Quality-of-care review was done in 2 basic steps. First, clerical employees of the Foundation screened all ambulatory claims (except prescriptions) using guidelines developed by physician members of the EMCRO. If the service on a claim conformed to the guidelines, the physician would quite likely be reimbursed. Reimbursement was not automatic, however, because some claims might be subject to further review if the physician submitted frequent claims for the same patient or the same diagnosis or if the physician's past behavior necessitated frequent peer review. Most antibiotic injections were subjected to physician review because their use was not automatically approved for many diagnoses.

Second, if information on claims, when compared with guidelines, indicated potentially low quality of care or inappropriate use, the claims were referred to physician reviewers for a decision as to whether further information should be requested from the physician or payment denied for the service because it was medically inappropriate.¶ Because of the computerized data base established and maintained by the EMCRO, the reviewing physician had access to up to 10 types of patient and physician profiles to aid him in making a decision. Based on this information, the physician then decided whether a claim should be paid or denied for medical reasons. If the claim was denied,** the reviewing physician was required to state a reason, which more than 90 per cent of the time was that the service was unwarranted for the diagnosis. When notified of the denial, the physician who had given the inappropriate service could appeal the decision of the reviewing physician to an appeals review committee. All physicians who treated Medicaid patients were sent the explicit guidelines, which were concerned mainly with the use of injections; some physicians also were involved in informal visits with the reviewing physicians.

During its 4 years of operation, the emphasis of the EMCRO's ambulatory care review activity was on injections. In January 1972, 4 months after the initiation of the peer review system, educational efforts were started among physicians who were overusing injections. These consisted mostly of informal contacts between physicians active in the Foundation and practicing physicians who seemed to be giving many unnecessary injections (mainly osteopathic physicians). In May 1972, the formal policy regarding use of injections was adopted by the Foundation and disseminated in written form to all physicians participating in the Medicaid program. Thereafter, denial of payment for those injections given for medical reasons not meeting the guidelines and for those injections the peer review physicians felt were medically unnecessary was begun in earnest. (Some denials for injections based on informal medical guidelines had begun in September 1971.)

¶ Reviewing physicians numbered over a hundred and were almost always practicing physicians.

** Throughout this report, we will refer to "services denied" (e.g., injections denied for medical reasons); this should be interpreted as meaning that payment for those services was denied for medical reasons.

The specific injection guidelines used for clerical and peer review (Table 1.1) were the standards used as of 1975 and represented almost exactly the same guidelines adopted in 1972. The injection guidelines were quite specific. For example, vitamin B_{12} was allowable only in cases of pernicious anemia, iron only for severe iron deficiency anemia or proven intolerance to oral iron and estrogen only in the event of intolerance to oral estrogen; antibiotic guidelines emphasized the use of long-acting (LA) penicillin (penicillin G benzathine) in streptococcal infection and discouraged use of short-acting (SA) penicillin and other antibiotics. Medicaid regulations allowed for the payment of tetanus and DPT boosters only in situations with evidence of trauma (e.g. lacerations, burns). Routine immunizations were not covered by the New Mexico Medicaid program (because they were given in public health clinics) and were denied for administrative, not medical, reasons. Influenza vaccinations, however, were acceptable for all patients over the age of 65 and for patients under the age of 65 who had severe chronic problems in which influenza could be a serious complication.

Findings of the First 2-Year Study

An evaluation of the New Mexico EMCRO after 2 years of operation[7] focused on changes in the use of injections and the relationship between inappropriate use of injections and selected physician characteristics believed to be predictive of good quality of care. Findings of that study are summarized below, to provide some context for the present study and the empirical questions we chose to pursue here.

More than 95,000 injections were administered to the Medicaid population during the 2-year period; of these, 27,640 (29 per cent) were denied for medical reasons. Close to 50 per cent of the injections were antibiotics; about one-quarter of these, on average, were denied for medical reasons. Of the other major categories of injections (e.g., antinauseants and antiemetics, steroids, or hormones), between one-fifth and three-fifths, on average, were denied for medical reasons.

Injections in the 2-year period were grouped into 3 classes depending on variations over time in the number billed and the number denied for medical reasons. For an injectable drug to be included in Class I, 2 criteria had to be met: 1) a substantial drop in use over time; and 2) a high percentage of denials for medical reasons. Most types of antibiotic injections were in this class and the decline in their use was dramatic. A calculation based on the assumption that no decline in the injection rate would have occurred in the absence of the EMCRO indicated that the peer review system prevented an estimated 22,000 medically unnecessary antibiotic injections over the 2-year period.

Class II injections included 10 types of injectable drugs that met the following 2 criteria: 1) little or no change in the physician's use of injections; and 2) a fairly high percentage of denials for medical reasons. For these injections, neither the educational efforts nor the more direct sanctions were as successful as for Class I injections and they were highlighted for follow-up investigation.

Injections in Class III met 1 of 2 criteria: 1) a rise in the number of injections billed; or 2) a relatively low percentage of denials.

TABLE 1.1. Present Guidelines for Payment or Review of Specific Types of Injections

I. Specific Standards for Appropriate Injectables*

1. Vitamin B_{12}
    a. One injection per month for Vitamin B_{12} deficiency states (i.e., pernicious anemia, or malabsorption syndromes, including the autonomic neuropathy sometimes associated with diabetes).
    b. Two injections within one 2-week period for severe debilitation (following trauma, severe infections, operations, acute alcoholism). This will occur rarely in the doctor's office.
2. B-complex

    For severe nutritional problems where the patient is not able to take medication by mouth or where there are malabsorption syndromes, this will be approved. This will occur rarely in the doctor's office.
3. Imferon—for iron deficiencies where
    a. Patient has demonstrated intolerance of or unresponsiveness to oral iron.
    b. Patient needs immediate initiation of therapy for severe iron deficiency anemia (1 injection).
4. Gamma globulin
    a. For prevention or modification of rubeola or infectious hepatitis where direct contact has been proved.
    b. Bruton-type agammaglobulinemia.
    c. In certain cases using special immune globulin derived from sera of individuals hyperimmunized to a specific disease.
5. Antibiotics
    a. Long acting, all purpose or combination respository, containing benzathine penicillin in the appropriate doses, is an approved method of treatment in patients with suspected or proven Group A beta-hemolytic streptococcal conditions such as strep throat, acute tonsillitis, acute otitis media, acute sinusitis or acute pharyngitis (1 injection per illness episode).
    b. Erythromycin, cephalosporin or lincomycin when patient is allergic to penicillin in streptococcal condition.
    c. In gonococcal diseases, penicillin (or ampicillin) is indicated (spectinomycin and tetracycline, in that order, if allergic to penicillin).
    d. In syphilis, penicillin is also indicated (erythromycin and tetracycline, in that order, if allergic to penicillin). Multiple injections in syphilis are indicated. In areas where there are public health clinics, however, appropriate injections will be covered (allowed for payment) only on those dates of service prior to the first day that clinic services are available.
6. Injectable expectorants or cough medicines

    Never! Example: Gomenol
7. Estrogens

    Estrogens for menopausal syndromes will be covered (allowed for payment) only when the patient cannot take the drug orally, and the claim documents this situation.
8. Influenza vaccine
    a. For patients over 65 years.
    b. For patients under 65 years who are severely medically debilitated (e.g., severe respiratory or cardiac problems).
9. The use of ACTH is limited to diagnosis (in the plasma cortisol test to assess adrenal cortical function) or in the treatment of the following conditions:
    a. Certain cases of multiple sclerosis.
    b. Certain cases of myasthenia gravis.
    c. Certain cases of inflammatory bowel syndrome.

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* These are standards (as revised in 1973) used by the clerks to decide if injections could be paid without physician review. All injections not meeting these criteria were reviewed by a physician to determine medical appropriateness.

Table 1.1 Continued.

10. Tetanus Toxoid and DPT boosters are medically appropriate and may be paid whenever there is evidence of a trauma such as a laceration, burn, abrasion, animal bite, puncture wound, etc.

11. Xylocaine, Lidocaine, Procaine, and Novacaine are medically appropriate if a necessity for local anesthesia is indicated, i.e., suturing, needling, etc.

12. Antiasthmatics

    The following injections are medically appropriate for claims with a diagnosis of asthma.

    a. Epinephrine
    b. Aminophylline
    c. Susphrine
    d. Adrenaline and oil

13. Antiemetics

    When nausea and vomiting is indicated on the claim and an injection is given, all claims must be reviewed by a physician. The drugs listed below are examples of injections which must be reviewed:

    a. Compazine
    b. Dramamine
    c. Phenergan
    d. Sparine
    e. Tigan
    f. Vistaril
    g. Atarax

14. Myochrysine and Solganal (Gold)

    Injections of myochrysine and solganal for juvenile and adult rheumatoid arthritis are medically appropriate. These injections are given once a week for a period of 3 to 4 months. After this initial 3- to 4-month period, these injections will be given once a month. Any injections falling outside these guidelines must be sent to professional review.

15. Dilantin and Phenobarbital

    Injections of dilantin or phenobarbital are medically appropriate if the diagnosis is epilepsy or seizures.

The most important finding in this class of injections was that the use of LA penicillin doubled during the 2 years and was accompanied by a denial rate of only 10 per cent. When an injection was required for streptococcal infection, LA penicillin was considered by New Mexico EMCRO physicians to be the therapy of choice. Evidently, by the end of the 2 years, it was used in place of other antibiotics that were either potentially more dangerous or not the antibiotic of choice for the diagnosis. The findings about Classes I and III substantiated the claim that the peer review system improved the quality of medical care for this population, using the simple criterion of antibiotic injection use.

On the whole, the data demonstrated that the peer review system functioned rationally and consistently in accordance with established injection policies. It reduced the use of injections by modifying physician behavior through educational and direct sanction activities. It changed the administration pattern of antibiotic injections away from the use of SA penicillin and other antibiotics to LA penicillin. The questions that remained, however, included the following: for what had these antibiotics been used in the first place and what differences in oral drug use, if any, did the changes in injections make?

The 2-year study included analyses to examine the relationship between physician characteristics and use of injections. Three dependent variables were constructed: 1) number of injections billed per ambulatory visit; 2) number of injections for which payment was denied for medical reasons per ambulatory visit; and 3) number of injections whose payment was denied for medical reasons per number of injections billed (i.e., injections denied for medical reasons as a percentage of injections billed). The major explanatory variables for physicians in solo practice were as follows: age of physician, country of medical education (U.S. and Canadian schools versus all other foreign schools), specialty, board certification status,†† rural/urban location of practice, type of physician (Doctor of Osteopathy [DO] or Doctor of Medicine [MD]), and for one analysis only, group practice versus solo practice.

DOs had a higher rate of medically inappropriate use of injections than MDs, and noncertified physicians a higher rate than certified. Findings on physician age were equivocal; quality of care deteriorated with age for DOs but not MDs; for the latter, the poorest care was given by the youngest and oldest physicians. Foreign medical graduates did not give significantly poorer care than U.S. graduates. Quality of care did not vary systematically with practice location (rural versus urban). Results with regard to specialty were mixed: the poorest care was given by obstetricians/gynecologists, and the best care by pediatricians; general practitioners were not markedly different from internists. Finally, partnerships, groups and clinics tended to provide care superior to that provided by any class of solo physicians.

A small set of "outlier" physicians emerged, characterized by extremely high rates of denial of payment for injections for medical reasons. These physicians numbered 15 MDs and 7 DOs (7 per cent of the 313 solo physicians who provided care in at least 100 visits to the Medicaid population in the 2-year study period), and accounted for more than 40 per cent of all unnecessary injections but only 14 per cent of all ambulatory visits. Although both MDs and DOs were involved in this "outlier" group, the percentage giving inappropriate injections was higher for DOs than MDs. No pediatricians were included among MD outliers, and no internists, pediatricians, or surgeons were included among DO outliers. The group practice category had no outliers. In the present 4-year study, this same set of 22 physicians has been labeled as outlier physicians.‡‡

All physician types substantially improved their injection practices over the 2-year period, outliers the most. Arguably, some phenomenon other than the EMCRO might have produced the dramatic fall in injection use, but this seemed unlikely for at least 2 reasons. First, with respect to ambulatory care, injections were given close and nearly exclusive scrutiny by the EMCRO during most of the first 2 years of operation. Second, use of all other ambulatory services increased during this period (and the subsequent 2 years as well) while injection use continued to fall.[8] In particular, use of prescription drugs, which were not subjected to medical review (and thus served as a control for some external factors), rose by about 14 per cent over the 1971–1975 period.

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†† The distinction was between board-certified physicians and all other noncertified physicians. The latter category included physicians who were "board eligible"—i.e., those who had completed a sufficient number of years of training to qualify to take the board examination or had taken but failed the examination—and physicians who were not board-eligible. No data were available to distinguish among board-certified, board-eligible, and noncertified physicians.

‡‡ Because identified outliers might have been dropped from the Medicaid lists or left the state, we checked whether outliers had continued delivering services to the Medicaid population. All but 1 provided a large number of services in the last 2 years of the study (more than 100 ambulatory visits in 2 years).

At the end of the 2-year study, the permanence of the changes brought about by the peer review system was unknown; hence, investigation of the full 4 years of the EMCRO's operation would clarify whether an effect of this nature could be maintained over a longer time period. This question is considered in Chapters II and III. The injections guidelines were in most instances related to specific diagnoses. We wished to investigate, therefore, whether physicians shifted their use of ambulatory diagnoses over time to justify injections that would otherwise be disallowed. This question is treated in Chapter V. Findings on outlier physicians warranted additional investigation, especially regarding whether the marked improvement in their injection practices was maintained. This variable was retained in the analyses reported in later chapters.

Finally, because higher quality of care may represent more expensive care, and because the observed decrease in the use of injections might be associated with greater numbers of other services (prescriptions, office visits or laboratory tests), we examined these relationships through the episode-of-care analyses described in Chapter VI. Furthermore, the single quality-of-care criterion—namely, use of inappropriate injections—did distinguish among physician types and did isolate outlier physicians. To determine whether it would correctly predict poor quality of care using a broader spectrum of process criteria, the episode analyses reported in Chapter VI employed criteria encompassing several major facets of ambulatory care that could be evaluated with claims data (frequency of office visits, diagnostic procedures, and oral and injectable medications).

Methodologic Notes

The analyses reported in Chapters II through VI have certain elements in common. First, some analyses were done on a "before" and "after" basis. Period I is defined as the 5 months *preceding* dissemination of EMCRO injection guidelines, i.e., September 1971 to January 1972. Period II is September 1973 to January 1974, *after* most of the effect of the EMCRO on reducing injection use had been achieved. Unless otherwise noted, Periods I and II refer to these time frames throughout this report.§§ Some analyses refer to the "end of the study," which was defined as a 5-month period at the end of the fourth year (April-August 1975).

Second, the analyses were based either on the entire Medicaid population (irrespective of the length of enrollment) or on an AFDC cohort that had been enrolled in Medicaid continuously for 4 years. This cohort was selected for several reasons: 1) because it was relatively healthy, diagnosis-specific analyses were less confounded by the presence of underlying chronic diseases; 2) no Medicaid–Medicare "crossover" problems would be encountered; 3) it made up the largest fraction of the Medicaid population; and 4) no enrollee characteristic changed in this cohort except aging over the 4-year period.

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§§ For methodologic reasons, Periods I and II actually cover 6-month periods (September-February) in the episode analyses reported in Chapter VI. This slight modification does not affect the interpretation or conclusions in any material way.

II. Use of Selected Types of Injections

THIRTY-EIGHT pharmacologic groups of injections were specified for the 4-year injection analyses (Table 2.1). Injections were assigned, if possible, to 1 of 37 specific groups, depending on pharmacologic action, indications for use and other information contained in various drug manuals and formularies (such as the Physician's Desk Reference and the AMA National Drug Code). The residual (38th) "all other injections" group was less than 5 per cent of all injections billed. Some groups were single examples of a broader type of drug (e.g., short-acting [SA] penicillin as a separate antibiotic); others were more aggregated groups (e.g., antinauseants/antiemetics or diuretics); still others were single entities that were not subsets of any broader type of drug under study (e.g., vitamin B_{12}).

Injections Billed

Of all injections billed (Table 2.1), about half were antibiotics, chiefly SA and LA penicillin.* The next largest group of injections billed was immunizations. Other large groups included tranquilizers, analgesics and steroids. The number of injections billed per 100 eligibles (Fig. 2.1a) or per 100 ambulatory visits (Fig. 2.1b) decreased substantially over time, with the greatest drop between the first and second years. Simple regression analyses indicated that the number of injections billed per Medicaid eligible decreased 75 per cent and per AFDC eligible, 74 per cent. Similarly, the number of injections billed per ambulatory visit was estimated to have dropped 71 per cent for the total Medicaid population and 76 per cent for AFDC.[8]†

Injections Denied

The largest group of injections denied for medical reasons (Table 2.1) was antibiotics (46 per cent of all injections denied). The next largest groups were steroids, hormones, vitamin B_{12}, tranquilizers, analgesics, and all other injections.

Denial rates were quite low in Period I, reflecting start-up activities and the fact that large-scale denial of payments did not begin until late in the first year after the formal injection policy had been adopted (Figs. 2.1a, b). The percentage of injections denied with respect to the total billed rose from 21 per cent to 44 per cent in the first 2 years and then dropped to 20 per cent in the fourth year.

Population Rates of Use

Overall, injections billed per eligible and per ambulatory visit decreased considerably between the beginning and end of the study—from 8.2 to 3.2 injections per 100 eligibles per month. Initially, approximately 1 in 12 Medicaid eligibles per month had 1 injection; 4 years later, about 1 in 31 eligibles per month was receiving an injection. At both the start and finish of the study, around 20 per cent of all injections were being denied for medical reasons.

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* Henceforth, for injectable drugs, SA penicillin means penicillin G potassium or sodium and penicillin G procaine alone. Long-acting (LA) penicillin is penicillin G benzathine.

† The regression equations took the form of $Y = a + b_1X_1 + b_2X_2 + \text{error}$, where Y= the number of injections billed per 100 eligibles, X_1 = the month (scored from 1 to 48), and X_2 = a dummy variable for winter (December, January, February). The equations for injections billed per eligible explained 72 per cent of the variance for all Medicaid eligibles and 62 per cent for AFDC eligibles ($p < 0.001$). The equations per ambulatory visit explained 75 and 72 per cent, respectively ($p < 0.001$).

TABLE 2.1. Total Number of Injections Billed by Pharmacologic Type of Injection, New Mexico Medicaid Program September 1971 to August 1975

	Injections Billed		Injections Denied for Medical Reasons		
Type of Injection	Number	Per Cent of Total	Number	Per Cent	Per Cent of Number Billed
Antibiotics	79,510	47.4	19,613	45.5	24.7
SA Penicillin*	31,100		8,993		28.9
Lincomycin	10,769		3,614		33.6
Ampicillin	2,824		861		30.5
Tetracycline	4,462		2,063		46.2
LA penicillin*	27,243		2,889		10.6
Other antibiotics	1,248		509		40.8
Antibiotic-Antibiotic combinations	375		149		39.7
Antibiotic-nonantibiotic combinations	1,489		535		35.9
Antihistamines	3,998	2.4	1,302	3.0	32.6
Phenergan	2,006		522		26.0
Other	1,992		780		39.2
Antinauseant-antiemetics	2,756	1.6	414	1.0	15.0
Compazine	3,317	2.0	436	1.0	13.1
Tranquilizers	11,369	6.8	2,759	6.4	24.3
Hydroxyzine	4,190		1,377		32.9
Diazepam/chlordiazepoxide	2,933		748		25.5
Thorazine/promazine	4,246		634		14.9
Steroids	8,792	5.2	3,279	7.6	37.3
Decadron	2,020		690		34.2
Kenalog	1,382		425		30.8
Depo-Medrol	1,741		583		33.5
Other	3,649		1,581		43.3
ACTH	2,841	1.7	1,850	4.3	65.1
Hormones	5,511	3.3	3,180	7.4	57.7
Estrogen	3,748		2,493		66.5
Progesterone	1,273		411		32.3
Testosterone	490		276		56.3
Analgesics	9,354	5.6	2,501	5.8	26.7
Narcotic	6,929		1,559		22.5
Non-narcotic	2,425		942		38.8
Synthetic Antispasmodics	1,157	0.7	188	0.4	16.2
Immunizations	13,398	8.0	141	0.3	1.1
DPT	3,390		20		0.6
Tetanus	6,305		40		0.6
Influenza	2,130		65		3.1
Other	1,573		16		1.0
Allergens and Asthma Drugs	6,848	4.1	124	0.3	1.8
Gamma Globulin	1,925	1.1	107	0.2	5.6
Vitamin B_{12}	4,565	2.7	3,174	7.4	69.5
Iron	705	0.4	259	0.6	36.7
Diuretics	1,046	0.6	406	0.9	38.8
Expectorants	1,153	0.7	816	1.9	70.8
Gold	1,575	0.9	33	0.1	2.1
All Other Injections	7,873	4.7	2,494	5.8	31.7
Total	167,693	100.0	43,076	100.0	25.7

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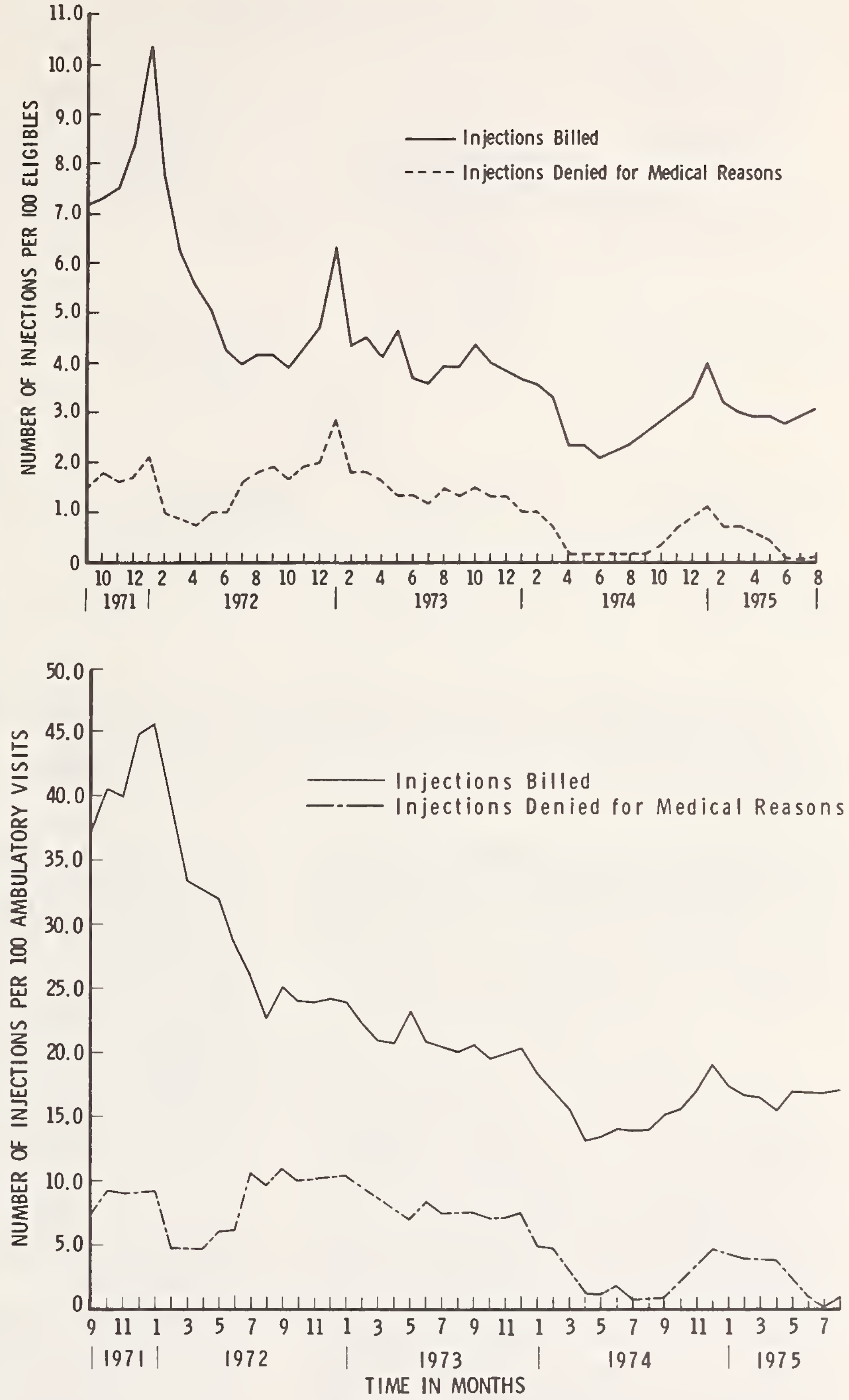
* SA is short-acting penicillin (penicillin G potassium or sodium and penicillin G procaine alone). LA is long-acting penicillin (penicillin G benzathine).



FIGS. 2.1A (top) and 2.1B (bottom). The upper graph depicts the total number of injections billed and denied for medical reasons per 100 Medicaid eligibles for the years 1971–1975; the lower graph displays the total number of injections billed and denied for medical reasons per 100 ambulatory visits for the same period.

Thus, at least 1 in 156 eligibles per month was still receiving a medically inappropriate injection toward the last part of the study.

Assuming only 1 injection per outpatient service (which is an underestimate), more than 37 per cent of all ambulatory visits (or 1 in every 2.6 visits) ended with an injec-

TABLE 2.2 Rates of Use and of Denial of Payment for Class I Injections

Denial-of-Payment Rate During Early Period of Enforcement of Guidelines*	Initial Rate of Use:†		
	High (Above 0.50)	Medium (0.20–0.50)	Low (Below 0.20)
Very high (above 70%)	Lincomycin Tetracycline ACTH Vitamin B_{12}	Estrogen	Expectorants
High (50–70%)	Other steroids	Antibiotic/nonantibiotic combination Diuretics	Testosterone Antibiotic/antibiotic combinations Other antibiotics Iron Depo-Medrol
Medium (30–50%)	SA Penicillin	Ampicillin All other injections	Nonnarcotic analgesics Decadron Kenalog Progesterone
Low (10–30%)			Synthetic antispasmodics Compazine

* Classification determined by the denial rate for half or more of the months between January 1972 and August 1973, inclusive.

† Classification determined by the number of injections billed per 100 eligibles in at least 1 month of the first year of the study.

tion initially; at the end, the figure was about 17 per cent (or just under 1 in 6 visits). With the 20 per cent denial rate at the end of the study, about 1 in 30 visits still ended in an inappropriate injection.

Classes of Injections

The EMCRO's diagnosis-specific guidelines for use of injections had the clear intention of severely reducing use of some injections and permitting or encouraging the use of a limited number of other injections. To examine the EMCRO's effect on injection use across the pharmacologic groups, the 38 types of injections were categorized into 3 classes, depending on variations in the number billed and denied over time.

Class I

Class I injections (Table 2.2) were defined as those injections whose use decreased substantially over the 4 years; they were further classified according to whether the initial level of use was high, medium or low.‡ With some exceptions, denial rates for these types of injections were quite high early in the study (e.g., more then 50 per cent denials for at least half of the injections in this class). Denial rates tended to stay comparatively high for many injections in this class (although based at the end of the study on very small numbers of injections). Twenty-three of the 38 types of injections were categorized in Class I.

Use of certain antibiotics (SA penicillin, lincomycin, tetracycline, and ampicillin) decreased significantly over the 4-year pe-

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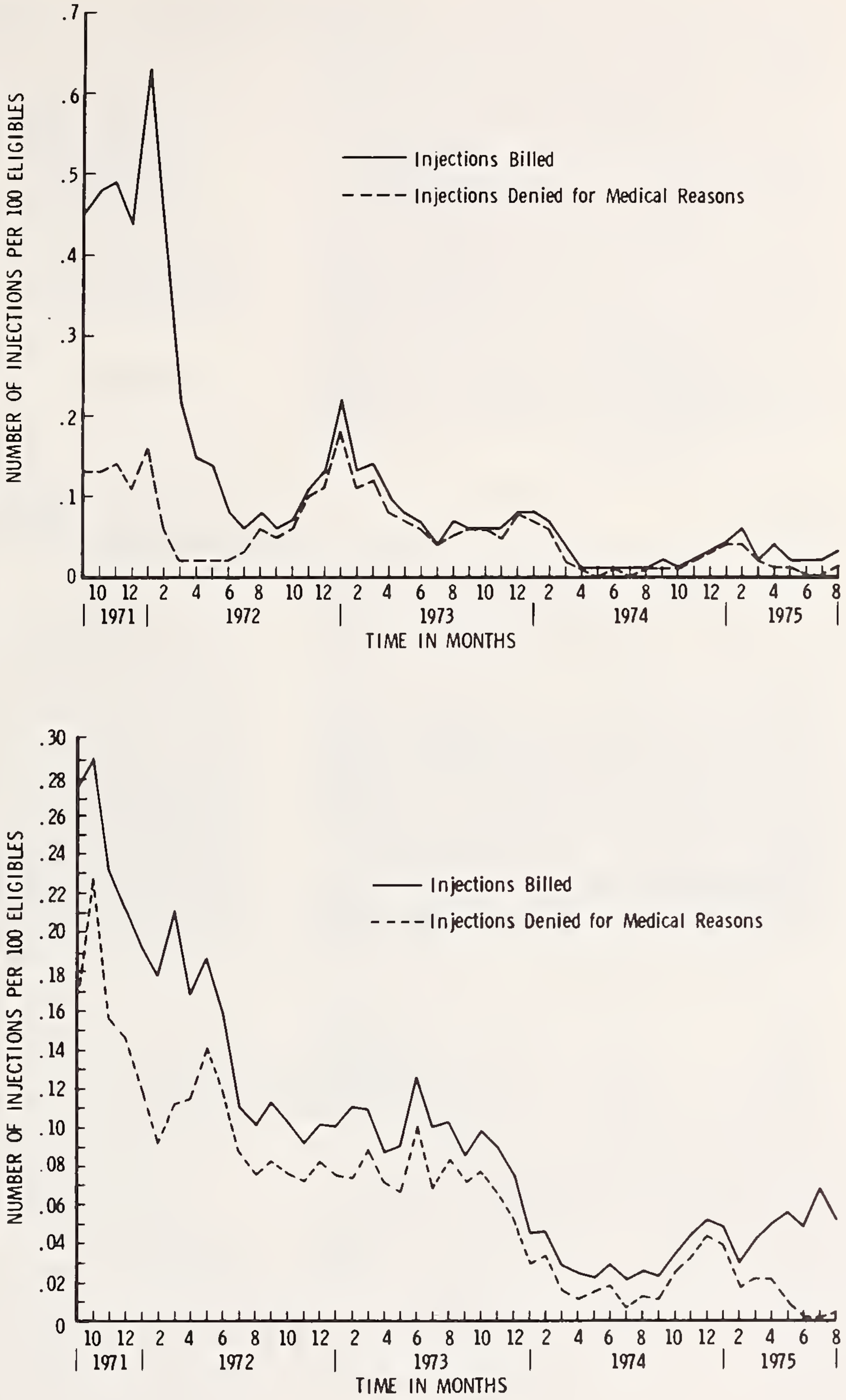
‡ High use was defined as more than 0.50 injections billed per 100 eligibles per month in at least 1 month of the first year of the study (typically within the first 5 months), medium use as 0.20 to 0.50 injections per 100 eligibles, and low as below 0.20 injections per 100 eligibles.



FIGS. 2.2A (top) and 2.2B (bottom). The upper graph depicts the number of tetracycline injections billed and denied for medical reasons per 100 Medicaid eligibles for the years 1971–1975; the lower graph displays the number of estrogen injections billed and denied for medical reasons per 100 Medicaid eligibles for the same period.

riod. The use of SA penicillin was markedly curtailed in line with EMCRO quality-of-care intentions; injectable lincomycin, ampicillin and tetracycline were virtually eliminated. Tetracycline (Fig. 2.2a) was a dramatic example.

The use of several other injections decreased substantially over the 4-year period, including steroids (other than Decadron, Kenalog, or Depo-medrol) and ACTH. The use of nearly all these injections began to decline by mid-1972 (i.e., within the first year following peer review); vitamin B_{12} remained high for 2 years before declining.

The remaining injections in Class I had started at moderate to low levels of use; consequently, the declines were not as impressive as with the antibiotics. These injections included diuretics, the remaining steroids, hormones, synthetic antispasmodics, iron, compazine, and all other injections. Estrogen was a typical example (Fig. 2.2b). Again, most of these injections began to decline soon after the promulgation of the injection guidelines in 1972.

Class II

The second class of injections (Table 2.3) included 6 pharmacologic types for which the number of injections billed either dropped only a little over the 4-year period or appeared to have a very steady rate of use over time. These included Phenergan, other antihistamines, certain tranquilizers, and antinauseants/antiemetics. Narcotic analgesics (Fig. 2.3) were illustrative.

Denial rates for this class were generally moderate to high in the early part of the study but (with the exception of hydroxyzine) dropped to fairly low levels over the latter part of the study. This class thus seemed to represent drugs that were used for a broad spectrum of conditions and that either were used with reasonable propriety and caution by the end of the study or were resistant to all efforts of the peer review system to bring about change.

TABLE 2.3. Rates of Use and of Denial of Payment for Class II Injections

Denial-of-Payment Rate During Early Period of Enforcement of Guidelines*	Initial Rate of Use:† Low (Below 0.20)
High (50–70%)	Other antihistamines
Medium (30–50%)	Hydroxyzine Diazepam Narcotic analgesics
Low (10–30%)	Phenergan Antinauseants/antiemetics

* See note, Table 2.2.

† See note, Table 2.2. Use of narcotic analgesics occasionally rose slightly above this threshold level.

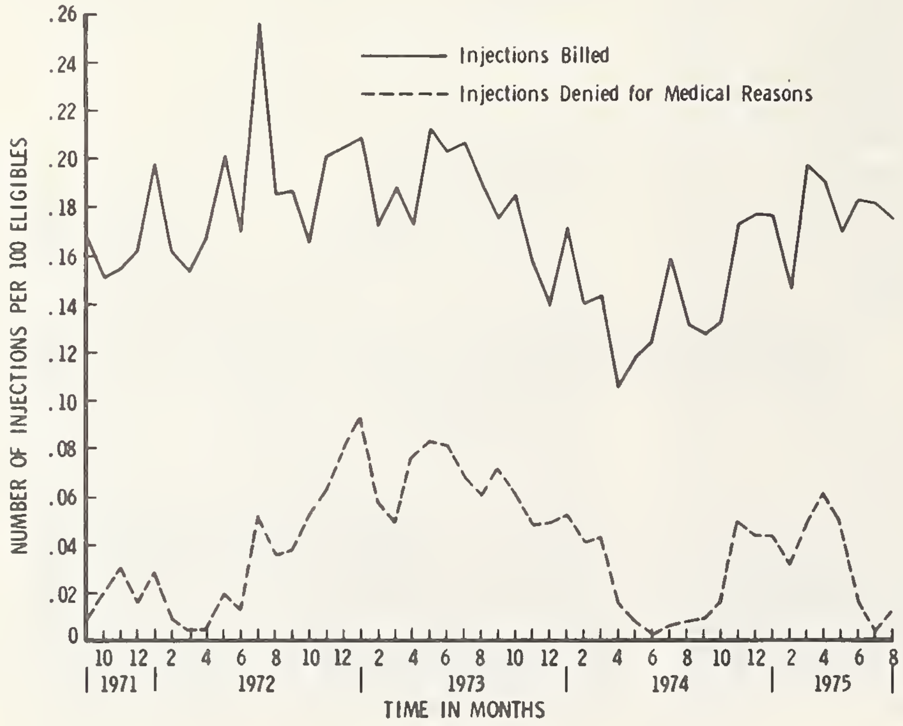


FIG. 2.3. Number of narcotic analgesics injections billed and denied for medical reasons per 100 Medicaid eligibles, 1971–1975.

TABLE 2.4. Rates of Use and of Denial of Payment for Class III Injections

Denial-of-Payment Rate During Early Period of Enforcement of Guidelines*	Rate of Use after 4 Years' Enforcement†		
	High (Above 0.50)	Medium (0.20–0.50)	Low (Below 0.20)
Medium (30–50%)			Thorazine‡
Low (10–30%)	LA Penicillin‡		
Very low (Below 10%)		Allergens/asthma drugs‡	Influenza‡ DPT‡ Tetanus§ Other immunizations§ Gamma globulin§ Gold§

* See note, Table 2.2.

† Classification determined by average number of injections billed per 100 eligibles per month in the last year of the study.

‡ Showed a rise in use over the 4 years.

§ Showed no change in use over the 4 years.

Class III

The third class of injections (Table 2.4) comprised the 9 types of injections for which the number billed per 100 eligibles either rose over 4 years (together with low denial rates) or was comparatively steady (but with extremely low denial rates). With the exception of chlorpromazine hydrochloride (Thorazine) (discussed below), denial rates for the Class III injections were all quite low over the entire period. In short, this represents a class of injections that in general were used appropriately throughout the study.

In contrast to all the other antibiotics (discussed in Class I above), use of LA penicillin (Fig. 2.4) rose over time; not unexpectedly, it also showed a marked (winter) seasonality. Other injections whose use rose over time were 2 types of immunizations§ (influenza and DPT boosters) and allergens/asthma drugs.

Use of the remaining immunizations (tetanus, gamma globulin and other immunizations) and gold appeared to be quite steady over time, which would seem to place them in Class II. Their denial rates, however, were so much lower than those for the Class II injection groups that they were felt to belong more properly to Class III.

Thorazine had a unique pattern. Early in the study, it had quite low levels of use and moderately high denial rates. Between the second and fourth years, however, the rate of injections given per 100 eligibles per month went from 0.06 to 0.16, and its use remained comparatively high for the remainder of the study. Moreover, the denial rate declined somewhat at the same time. The explanation for this rise in the use of Thorazine is unclear.

Discussion

Based on these data, the following conclusions were drawn about the effect of the EMCRO over the 4 years of its operations.

1. Use of injections in toto dropped more than 70 per cent between the start

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§ DPT as a common periodic immunization for children is not covered by the New Mexico Medicaid program, because those immunizations are provided free of charge through another agency. DPT injections are allowed as tetanus boosters, however.

and end of EMCRO activities. This effect was mostly achieved within 2 years of the beginning of active review, since the use of injections per Medicaid eligible had dropped an estimated 60 per cent by the end of 2 years.

2. Substantial declines in use were achieved for a wide variety of injections. The greatest declines were among those injections with potentially more serious side effects, those with more specific indications for use, and those that were abused the most when the EMCRO program first began.

3. Declines were generally sustained; subsequent rises in use among injection types that initially had been curtailed drastically were slight or nonexistent.

4. A nontrivial amount of inappropriate injection treatment was observed even at the end of the study; more than 20 per cent of all injections were still being denied for medical reasons at the start of the fourth year and about 16 per cent at the end of that year. The implication seemed to be that at least some physicians will continue to give certain types of injections even when they have every reason to expect they will not be reimbursed for them. The types of injections that seemed to fall into this category included SA penicillin, antihistamines, hydroxyzine, steroids and hormones.

5. These changes in use of injectable drugs—especially potent agents such as the antibiotics—were considered a clinically important improvement in the quality of ambulatory care because of the side effects and iatrogenic problems avoided and because the overall care provided came more into line with accepted criteria.

We drew several implications for quality assurance programs from these findings. First, given that a quality-of-care problem is identified and a decision made to attempt to correct it, PSROs should be able to make major progress on the problem within a fairly short period (e.g., 2 years or so). Second, 100 per cent (i.e., case-by-case) review is probably unnecessary after the major part of a problem has been corrected; with respect to injections in New Mexico, this was certainly true after 3 years of peer review. Thus, the effect of a peer review system can probably be maintained with substantially less expenditure of time and resources once the major lessons have

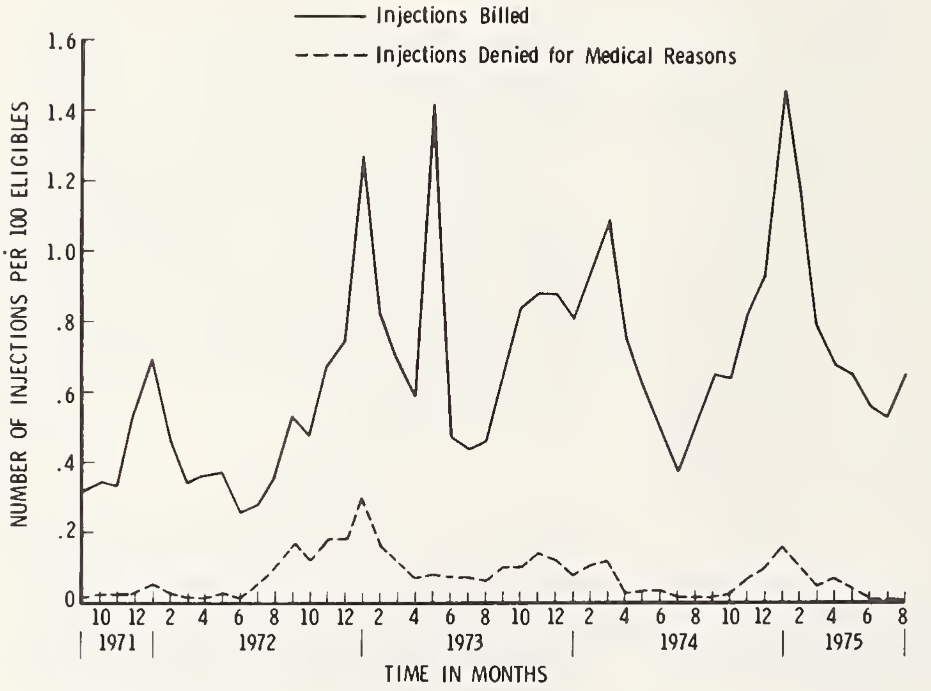

FIG. 2.4. Number of injections of long-acting penicillin billed and denied for medical reasons per 100 Medicaid eligibles, 1971–1975.

been learned, and the quality assurance program can turn from case-by-case review (or prepayment review) to more cost-effective sampling techniques (or retrospective review).

Third, the 2-part mechanism by which the EMCRO successfully modified injection use deserves further study; it involved developing guidelines and carrying out educational efforts directed at physicians whose practice patterns apparently conflicted most with those guidelines, followed several months later by sanctions in the form of denials of payment for inappropriate injections. This approach was undertaken in New Mexico partly in response to the serious abuse of injections recognized by many physician leaders, and hence the circumstances may have favored successful implementation. Although an approach relying in the first instance on educational interventions is not automatically transferable to other types of services (or to other peer review systems, for that matter), attempts to extend it would seem to be warranted.

Some of these conclusions seem to have been borne out by subsequent events. The EMCRO became a conditional PSRO in November 1974 and maintained the review system described in Chapter I through August 1975. Thereafter, a new system for ambulatory care review began, as described in Ryland et al.[74] It included features such as precoded (specialty-specific) claim forms for physicians who were quite active in the Medicaid program. More to the point, it contained a sampling or focused approach to review of ambulatory care. This was possible in part because of the extensive and virtually complete computerized data files on patients and physicians that were maintained by The Dikewood Corporation (the EMCRO fiscal intermediary up to that time).

The first component of the new review system was retrospective review of all physicians with 10 or more patient encounters for a given diagnosis during a 6-month period. The review could focus on one or a combination of elements of those encounters (such as laboratory tests, injections, prescriptions, roentgenography, outpatient surgical procedures or other diagnostic procedures). Through 3 "levels" of reports, specific treatment patterns could be examined. Reports could divide physicians into 3 statistical distributions (10th, 50th and 90th percentiles) or focus on care given to individual patients, and typically were used to identify anomalies that needed to be referred to the Ambulatory Care or Education Committees of the PSRO. (With the change of fiscal agent in October 1977, however, these statistical profiles were abolished. New retrospective review capabilities were expected to be devised.)

Based on these reports, if a clerical reviewer decided that peer review of the physician profile was necessary, then the profile was forwarded to a reviewing physician, who had a number of options, including referring the material about a physician to either an Ambulatory Care Committee (if the problem appeared to be one of utilization) or an Education Committee (if the problem was more one of quality). Some of these activities have been evaluated.[28,29]

The second component of the review system was 100 per cent prepayment review of claims submitted by approximately 10 per cent of Medicaid physicians who had been identified as providing inadequate or excessive care. This approach had the effect of focusing only on physicians and not on problems or diagnoses; hence, if only 10 per cent of the services of a physician on prepayment review were questionable, the other 90 per cent were also (perhaps unnecessarily) reviewed. This is an inefficient approach that could lead to inconsistencies, if not inequities, because these latter services—compared with equivalent services of physicians not on prepayment review—were more likely to be denied simply by virtue of being reviewed.

This sampling review system became operational in February 1976, and continued until roughly October 1977, when the state Medicaid program changed fiscal intermediaries. During that time, between 60 and 70 physicians had been on 100 per cent prepayment review.

Finally, between October 1976 and 1978, the New Mexico PSRO was 1 of 5 ambulatory care review demonstration projects funded by the Health Standards and Quality Bureau, Health Care Financing Administration, Department of Health, Education, and Welfare. Among other tasks, the PSRO did several research projects focused on identifying and correcting problems of contraindicated treatments and modifying physician behavior through education. Both activities were successfully carried out with the claims-based computerized data set using physician/patient/treatment profiles to isolate important problems and to identify physicians needing further intervention.[29] Interestingly, the change in fiscal intermediary (because of financial considerations, not performance) was noted to be "disruptive to the point that success was threatened in every major area of Project activity."[29]

III. Physician Characteristics and Appropriate Use of Injections

THE SECOND PHASE of this study concerned how different types of physicians used injections. During the 4-year study, an average of about 84,520 persons per month were eligible for Medicaid services. They received a total of 749,800 ambulatory visits and 167,690 injections. These services were associated with a total of 1,483 medical providers (i.e., different provider numbers). Of these, 1,155 were MDs, 150 were DOs, 177 were group practices, and 1 was a dummy provider number assigned to all services billed for which no referring physician was known.

We restricted our analyses to 358 "active" Medicaid physicians, i.e. those who billed at least 100 ambulatory visits in the first 2 years of the study. This was done to focus the analysis on physicians who were at least minimally active in the Medicaid program and who thus were likely to be exposed to and affected by the peer review system. They included 232 MDs in solo practice, 81 DOs in solo practice, 38 group practices (all but 1 were MD groups) and 7 facilities with no resident physician. The group practices varied widely and included 2 large multispecialty groups and several small single-specialty clinics. Paramedical professionals staffed full-time the 7 facilities with no resident physician. Physicians attended these facilities on a rotating basis; they were usually board-certified physicians from larger facilities in more urbanized areas. These 358 providers, approximately one-quarter of all providers delivering services to the Medicaid population, accounted for almost 626,080 ambulatory visits (84 per cent of those matched to a provider number), almost 126,300 injections billed (75 per cent of those matched), and almost 34,530 injections denied (80 per cent of those matched).

Aggregate Use of Visits and Injections

Type of Practice and Provider

Physicians in solo practices provided most of the ambulatory visits; they accounted for even larger proportions of injections billed and (especially) denied (Table 3.1). MDs in solo practice accounted for 40 per cent of the total number of ambulatory visits, 38 per cent of the injections billed, and 41 per cent of the injections denied. For the DO solo providers, the figures were 33, 46 and 48 per cent, respectively.

Board Certification Status

Board-certified providers, including both solo practitioners and group practices, provided 34 per cent of the ambulatory visits, 21 per cent of the injections billed and 11 per cent of the injections denied (Table 3.2). For noncertified physicians, the figures were 60, 71 and 77 per cent, respectively. The remaining services were given by 28 providers on whom board certification status was unknown. Because data on provider characteristics were obtained from several sources, including professional associations, most if not all of the unknown providers were probably not board certified.

Board-certified solo practitioners accounted for 16 per cent of the visits but only 8 per cent of the denied injections, whereas noncertified solo practitioners accounted for 56 per cent of the visits and 74 per cent of the denied injections. Among the group practices, the pattern was somewhat different; board-certified groups accounted for 18 per cent of the visits but only 3 per cent of the denied injections, whereas noncertified groups accounted for 4 per cent of the visits and 3 per cent of the denied injections.

TABLE 3.1. Distribution of Services by Type of Practice and Provider

Type of Practice and Provider	Number of Providers	Ambulatory Visits		Injections Billed		Injections Denied	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
Solo practice	313	460,300	74	105,641	84	30,720	89
MD	232	252,451	40	48,149	38	14,242	41
DO	81	207,849	33	57,492	46	16,478	48
Group practice*	45	165,778	26	20,655	16	3,809	11
Total	358	626,078	100	126,296	100	34,529	100

* Includes facilities with no resident physicians.

Specialty

Specialty was determined for virtually all providers (Table 3.3). Group practices were classified as 1 of 5 single specialties, multispecialty, or unknown. The 7 "nonphysician facilities" appear in either the general practice or unknown classification of group practice.

General practitioners in solo practice accounted for the bulk of the ambulatory visits, injections billed, and (especially) injections denied. In addition, DO obstetricians/gynecologists and all other DO specialists apparently accounted for a disproportionately large number of injections denied. Pediatrics and internal medicine appeared to be under-represented among injections denied. Although the multispecialty clinics accounted for a large fraction of ambulatory visits, they contributed only a very small proportion of injections denied.

Outlier Physicians

Outliers among the solo physicians accounted for only 14 per cent of the ambulatory visits and 29 per cent of the injections billed over the 4 years (Table 3.4). They were responsible for a large percentage of injections denied (41 per cent). By contrast, the remaining solo providers accounted for 60 per cent of ambulatory visits, 54 per cent of injections billed, and 49 per cent of injections denied.

TABLE 3.2 Distribution of Services by Board-Certification Status, Type of Provider, and Type of Practice

Type of Provider	Number of Providers	Ambulatory Visits		Injections Billed		Injections Denied	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
Board-certified	130	214,497	34	26,536	21	3,862	11
MD	96	82,186	13	10,969	9	2,218	6
DO	9	19,667	3	3,338	3	646	2
Group	25	112,644	18	12,229	10	998	3
Non-board-certified	200	375,405	60	89,530	71	26,573	77
MD	124	162,312	26	32,381	26	9,881	29
DO	69	185,924	30	53,233	42	15,679	45
Group	7	27,169	4	3,916	3	1,013	3
Unknown	28	36,176	6	10,230	8	4,094	12
MD	12	7,953	1	4,799	4	2,143	6
DO	3	2,258	<1	921	1	153	<1
Group	13	25,965	4	4,510	4	1,798	5
Total	358	626,078	100	126,296	100	34,529	100

TABLE 3.3. Distribution of Services by Type of Provider, Type of Practice and Specialty

Type of Provider and Specialty	Number of Providers	Ambulatory Visits		Injections Billed		Injections Denied	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
MD solo practice	232	252,454	40	48,149	38	14,242	41
General practice	84	131,385	21	28,117	22	8,195	24
Internal medicine	31	35,117	—	6,069	5	1,699	5
Pediatrics*	23	27,336	4	4,072	3	572	2
Obstetrics-gynecology	16	7,092	1	1,049	1	333	1
General surgery	61	37,783	6	6,114	5	2,459	7
All other specialties†	17	13,741	2	2,728	2	984	3
DO solo practice	81	208,749	33	57,492	46	16,478	48
General practice	45	139,357	22	35,301	28	9,293	27
Internal medicine*	2	2,505	<1	188	<1	39	<1
Pediatrics*	2	6,936	1	764	1	164	<1
Obstetrics-gynecology	10	23,190	4	9,664	8	3,556	10
General surgery*	15	29,529	5	8,288	7	1,916	6
All other specialties	7	7,232	1	3,287	3	1,510	4
Group practice	45	165,778	26	20,655	16	3,809	11
General practice‡	16	43,722	7	7,751	6	2,635	8
Internal medicine	1	551	<1	98	<1	18	<1
Pediatrics	1	2,430	<1	271	<1	7	<1
Obstetrics-gynecology§	6	3,427	1	126	<1	45	<1
General surgery	3	1,967	<1	13	<1	3	<1
Unknown specialties‖	13	14,841	2	1,761	1	371	1
Multispecialty	5	98,840	16	10,635	8	730	2

* No outliers in this specialty.

† Includes 1 of unknown specialty.

‡ Includes the 1 DO group.

§ Includes 1 of the "no resident physician" groups.

‖ Includes 6 of the "no resident physician" groups.

TABLE 3.4. Distribution of Services by Type of Provider, Type of Practice and "Outlier" Status

Type of Provider	Number of Providers	Ambulatory Visits		Injections Billed		Injections Denied	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
MD solo practice	232	242,451	40	48,149	38	14,242	41
Outlier	15	47,510	8	17,655	14	7,461	22
Other	217	204,941	33	30,494	24	6,781	20
DO solo practice	81	207,849	33	57,492	46	16,478	48
Outlier	7	36,059	6	19,358	15	6,621	19
Other	74	171,790	27	38,134	30	9,857	29
Group practice*	45	165,778	26	20,655	16	3,809	11
Total	358	626,078	100	126,296	100	34,529	100

* There were no outliers among group practices.

Summary

These aggregate counts of services given by various classifications of providers confirm findings from the 2-year study: "better" care was concentrated in group practices (especially multispecialty clinics), board-certified physicians, MD pediatricians, and (by definition) physicians other than the several "outlier" practitioners.

Rates of Injection Use and Denial by Ambulatory Visit

Type of Practice and Provider

The pattern of changes in rates of injections billed per ambulatory visit as a function of time differed between group practices and solo physicians (Fig. 3.1). The billed-per-visit rate for groups rose slightly between Periods I and II* (from 0.13 to 0.15) before eventually dropping slightly (to 0.10) by the end of 4 years. The rates dropped markedly for both MD and DO solo providers between Periods I and II (from 0.31 to 0.18 and from 0.64 to 0.21) and decreased slightly thereafter (to 0.14 and 0.17, respectively, by the end of the study). Overall, the percentage decrease in injections billed per visit was 24 per cent for all group practices, 56 per cent for solo MDs, and 73 per cent for solo DOs.

The number of injections denied per visit for all providers including group practices increased substantially in the second year of the study. All providers showed a dip in denials in the third year and a rise in part of the fourth year of the study.

Denial rates were lower for groups than for MD and DO solo providers. In Period I, the denied-per-visit rate for groups was 0.01, compared with 0.07 for MDs and 0.15 for DOs. In Period II, the figures were 0.01, 0.07 and 0.08, respectively, and by the end of the study, 0.003, 0.02 and 0.02, respectively.

Board Certification Status

In the early months of the study, both certified and noncertified DOs had higher rates of injections billed than did MDs (Fig. 3.2). By the end of the 4 years, however, the certified DOs had rates comparable to (or lower than) their certified MD counterparts, and in general the rates became quite similar.

In Period I, billed rates were 0.49 and 0.66 for certified and noncertified DOs,

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* Recall that Period I refers to the first 5 months of the study before peer review, and Period II refers to the equivalent months 2 years later. See Chapter I for the full definition.

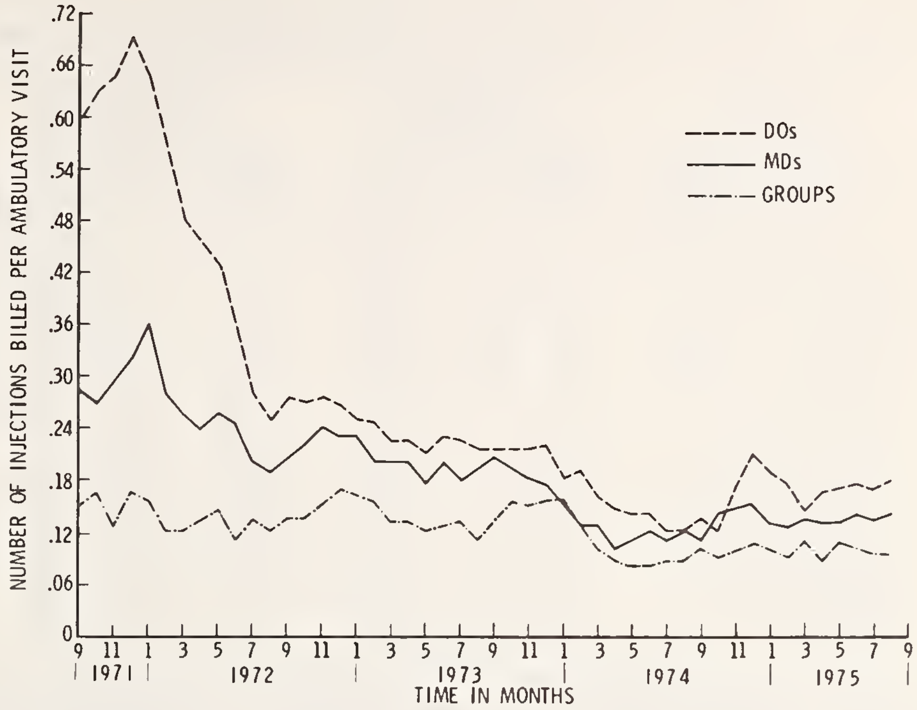

FIG. 3.1. Number of injections billed per ambulatory visit, by type of provider.

compared with 0.17 and 0.34 for MDs (Table 3.5). By the end of the study, the rates were down to 0.11 and 0.13 (for certified MDs and DOs). Between Periods I and II, use of injections fell 42 per cent for all certified physicians and 59 per cent for all noncertified physicians; between Period I and the end of the study, the declines were 52 and 68 per cent, respectively.

Differences among providers were basically the same for injections denied and injections billed. In Period I, provider type

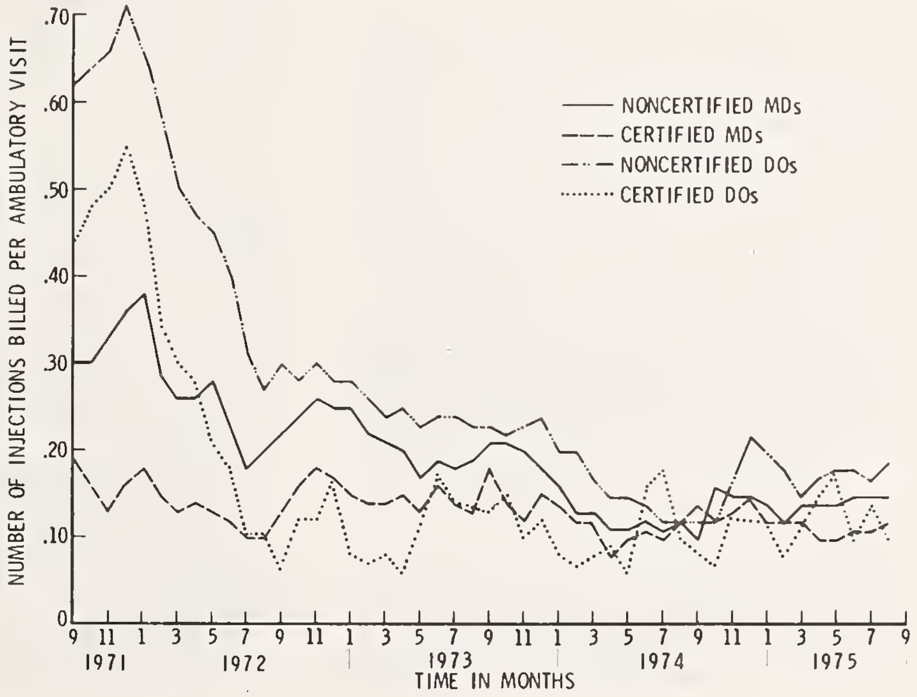

FIG. 3.2. Number of injections billed per ambulatory visit, by type of provider and board-certification status.

Table 3.5. Appropriateness of Use of Injections by Type of Solo Provider and Board-Certification Status, for 3 Selected Periods*

Type of Solo Provider and Board-Certification Status	Injections Billed per Visit			Injections Denied per Visit			Injections Denied per Billed		
	Period I†	Period II	End of Study	Period I	Period II	End of Study	Period I	Period II	End of Study
Total solo practice									
MD	.31	.18	.14	.07	.07	.02	.22	.37	.13
DO	.64	.21	.17	.15	.08	.02	.24	.38	.08
Total certified	.24	.14	.11	.04	.04	.01	.16	.28	.10
Certified MD	.17	.14	.11	.02	.04	.01	.15	.28	.10
Certified DO	.49	.11	.13	.09	.03	.02	.18	.27	.13
Total noncertified	.51	.21	.16	.12	.08	.02	.23	.36	.11
Noncertified MD	.34	.19	.15	.07	.06	.02	.20	.33	.14
Noncertified DO	.66	.22	.18	.16	.09	.02	.24	.38	.09
Total unknown	.84	.36	.27	.29	.15	.04	.35	.41	.16
Unknown MD	.93	.37	.34	.38	.15	.06	.41	.41	.17
Unknown DO	.67	.14	.11	.14	.09	.01	.20	.67	.11

* Rates were calculated to 4 decimal places and rounded to 2 places for presentation.

† Period I: September 1971 to January 1972; Period II: September 1973 to January 1974; End of Study: April 1975 to August 1975.

(MD or DO, whether certified or not) was the distinguishing characteristic in predicting high or low denial rates. Within the first year, however, the key variable became board certification status; by Period II, the rates of denials were quite similar for MDs and DOs and stayed so until the end of the study.

Certified and noncertified group practices generally had lower billed rates than did the equivalent solo-practice classifications. The number of injections billed per visit in Period I was 0.12 for certified groups and 0.16 for noncertified; respective figures for Period II were 0.11 and 0.21, and for the end of the study, 0.09 and 0.12. By the end of the study, therefore, use of injections in ambulatory visits had declined about 30 per cent for both sets of group practices.

Specialty

Data for primary care providers by specialty should be interpreted with care because of the small number of physicians (although not visits) in some classifications such as pediatrics (Table 3.6). In Period I, all DO specialists except internists had very high rates of injection use (ranging from 0.43 to 0.86 injections per visit). These high rates dropped markedly by Period II for DOs in obstetrics/gynecology, surgery, and general practice, stabilizing at rates similar to their MD counterparts; rates for DOs in internal medicine and pediatrics dropped to levels lower than those for their MD colleagues. For MDs, surgery and general practice had quite high rates of injection use (0.33 and 0.37 in Period I) and pediatrics quite low (0.16). By Period II (and by the end of the study), injection use by MDs in pediatrics stayed low, use in internal medicine and general practice dropped to rates equivalent to pediatrics, use in surgery declined notably to levels lower than pediatrics, and use in obstetrics/gynecology varied over time but remained generally higher than in pediatrics.

Rates of injections billed were compared between multispecialty groups and all

TABLE 3.6. Appropriateness of use of Injections by Type of Provider and Specialty, for 3 Selected Periods[*]

Type of Provider and Specialty	Injections Billed per Visit			Injections Denied per Visit			Injections Denied per Billed		
	Period I[†]	Period II	End of Study	Period I	Period II	End of Study	Period I	Period II	End of Study
MD solo practice									
General practice	.37	.21	.16	.07	.09	.02	.18	.41	.15
Internal medicine	.23	.21	.11	.06	.06	.01	.26	.29	.09
Pediatrics	.16	.15	.14	<.01	.03	.01	.03	.23	.10
Obstetrics/gynecology	.23	.16	.12	.06	.06	<.01	.26	.35	.01
General surgery	.33	.09	.08	.12	.03	.01	.38	.37	.15
DO solo practice									
General practice	.61	.19	.12	.13	.06	.01	.22	.31	.11
Internal medicine	.24	.02	.09	.04	<.01	.03	.15	.17	.33
Pediatrics	.43	.08	.06	.06	.02	—	.14	.28	—
Obstetrics/gynecology	.86	.41	.26	.23	.21	.03	.27	.51	.13
General surgery	.65	.16	.26	.19	.07	.01	.29	.46	.03
Multispecialty groups	.13	.11	.09	<.01	.01	<.01	.02	.12	.03
All other groups	.20	.20	.11	.02	.07	.02	.12	.35	.17

[*] Rates were calculated to 4 decimal places and rounded to 2 places for presentation.

[†] Period I: September 1971 to January 1972; Period II: September 1973 to January 1974; End of Study: April 1975 to August 1975.

other group practices together (both single-specialty and general practice) because there were too few groups in any one specialty to warrant further disaggregation. The billed rate went from 0.13 to 0.11 for the multispecialty groups between Periods I and II, and then dropped to 0.09; for all other groups, the figures were 0.20, 0.20, and 0.11.

Outlier Physicians

Patterns of injection use for outlier physicians (both MD and DO) changed considerably over time (more than for all other solo physicians taken together) (Fig. 3.3). Although the major part of the decline in injections billed per visit for physicians other than outliers was accomplished within 1 year of the start of EMCRO operations, nearly 3 years passed before the outliers reached an analogous low plateau in injection use. Interestingly, outlier DOs stabilized at a rate equivalent to the level that all other physicians experienced during Period I, and outlier MDs at a somewhat lower level, closer to where all other physicians had been after 1 year of EMCRO operation.

For outlier MDs (Table 3.7), injections billed per visit went from 0.75 to 0.30 between Periods I and II, and then declined to 0.18 by the end of the study; respective rates for outlier DOs were 0.92, 0.48 and 0.27. As expected, the rate was substantially lower for MDs in Periods I and II than for DOs and more nearly alike by the end of the study. In terms of the percentage change over time in injection use, the 4-year decline was as follows: outlier MDs, 76 per cent; outlier DOs, 70 per cent; other MDs, 31 per cent; other DOs, 73 per cent.

The rates of injection denials per visit for outlier physicians were higher in Periods I and II for outlier DOs than for outlier MDs, but by the end of the study, the rates were virtually identical for the 2 classifications and were only slightly higher than the rate for all other physicians.

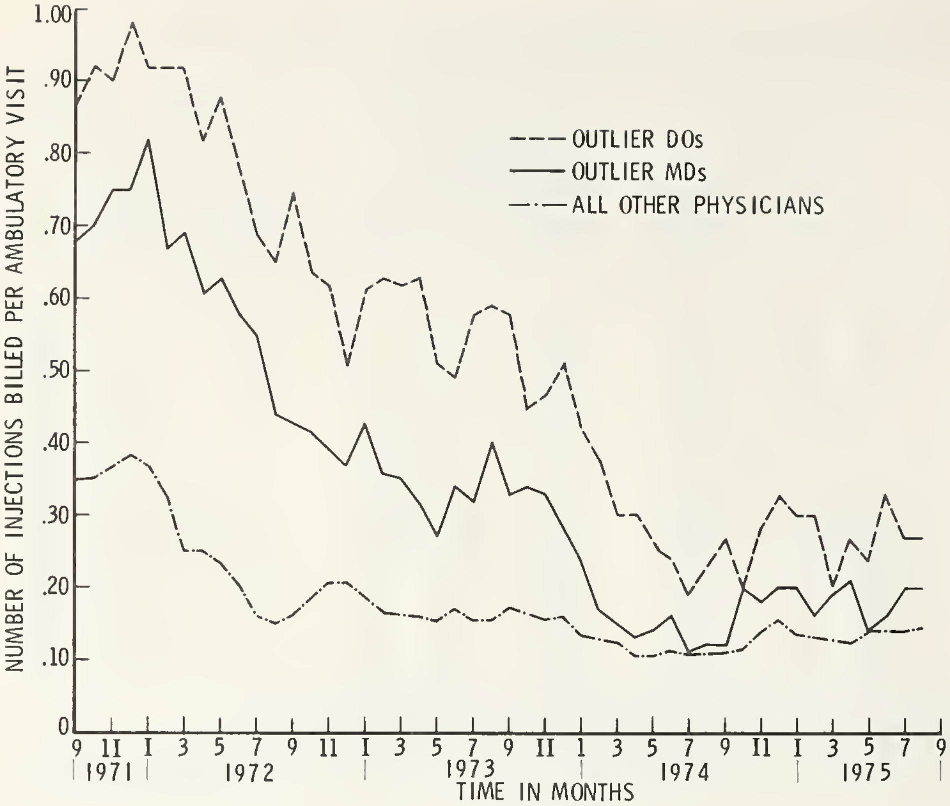

FIG. 3.3. Number of injections billed per ambulatory visit, by type of provider and outlier status.

Summary

The evidence from this phase of the study supported the following views: 1) board certification had a positive effect on appropriate use of injections in both the solo and the group practice setting; 2) specialty was a distinguishing characteristic, with poorer care generally associated with general practice and obstetrics/gynecology and better care with pediatrics; 3) type of practice (multispecialty groups) had an independent effect on appropriateness of care; 4) outlier physicians improved most in their delivery of care but still had high rates of injection use compared with their peers; and 5) the MD/DO classification became less important during the study in predicting inappropriate care.

TABLE 3.7. Appropriateness of Use of Injections by Provider Type and Outlier Status, For 3 Selected Periods[*]

Type of Provider and Outlier Status	Injections Billed per Visit			Injections Denied per Visit			Injections Denied per Billed		
	Period I[†]	Period II	End of Study	Period I	Period II	End of Study	Period I	Period II	End of Study
Outlier MD	.75	.30	.18	.21	.16	.03	.28	.53	.17
Other MD	.19	.15	.13	.03	.04	.01	.16	.29	.11
Outlier DO	.92	.48	.27	.23	.19	.03	.25	.40	.10
Other DO	.57	.17	.15	.13	.06	.01	.23	.37	.08

[*] Rates were calculated to 4 decimal places and rounded to 2 places for presentation.

[†] Period I: September 1971 to January 1972; September 1973 to January 1974; End of Study: April 1975 to August 1975.

Implicit Effect of EMCRO on Injections

We calculated the number of injections that were prevented from being given during the 4 years as a crude quantitative measure of the implicit effect of the EMCRO on quality of care. The number of injections prevented is the difference between the number actually billed over 4 years and the estimated number that would have been billed if the rate of use (i.e., injections per ambulatory visit) in, say, Period I had prevailed throughout the study.

Over the 4 years, some 750,350 ambulatory visits were given. In Period I (when use of injections was rising and little review was being done), the average number of injections per ambulatory visit was calculated to be 0.42. Multiplying this figure by the number of ambulatory visits yields the expected number of injections (315,150) that would have been given in the absence of peer review of injections. The difference between this figure and the number actually given (167,690) yields an estimated 147,460 injections prevented. Of these, about 35,000 would have been for lincomycin, 15,050 for tetracycline, and 60,450 for short-acting penicillin.

We estimated the gross dollar "savings" to the Medicaid program from injections that were not given. Several costs of an injection might be used to calculate such savings, such as the average billed cost over the total period ($4.14), average billed cost in the first month ($4.00), or average cost of antibiotic injections ($4.38), which represented about one-half of injections given and prevented. Using the $4 figure, gross savings (i.e., before expenses of running the peer review system are deducted) were conservatively estimated to be almost $590,000 in 4 years.

Similar calculations by physician characteristic were made for the 358 providers under study here (Table 3.8). They gave 75 per cent of all injections and had 75 per cent of the "prevented" injections. Using this measure, the EMCRO's major effect was on noncertified DOs, principally those in general practice. As might be expected from the overall decrease (of more than 70 per cent) in injections billed, for some provider classifications the number of injections "not given" was higher than the number actually administered. This was true most notably for DOs in virtually all categories (i.e., certified and noncertified, all primary care specialties).

Discussion

This phase of the study brought out the association between certain characteristics of physicians and more appropriate use of injections: these include group practice (compared to solo practice), especially for the few multispecialty clinics; being board-certified; being an MD rather than a DO; and being an MD pediatrician (compared with most other specialties). All physician types improved their use of injectable drugs, especially the small set of outlier physicians.

These associations were much more distinct in Period I than later in the study. By Period II (and certainly by the end of the study) the distinctions among providers in appropriate use of injections had faded. Thus, the peer review system served to equalize care given by differently trained physicians; i.e., it tended to dissipate some of the variance of care that arises as a function of innate features of physician training and practice setting. By the end of the study, being in a group practice, being an MD, or being board-certified was less important in predicting the appropriate use of injections than it had been formerly. Care in general improved, and the spread between the best and worst physicians narrowed. Certainly a major function of a peer review organization should be to reduce the variance in quality of care. Doing this (as in New Mexico) without lowering the general level of care was viewed as a major accomplishment.

TABLE 3.8. Estimated Number of Injections Prevented by Selected Provider Characteristics

Type of Provider*	Total Number of Ambulatory Visits	Injections Billed per Visit in Period I	Estimated Number of Injections Prevented
Outlier MD	47,510	.75	17,980
Other noncertified MD	114,802	.20	8,230
Certified MD	82,186	.17	3,000
Total MDs†	252,451	.31	30,110
Outlier DO	36,059	.92	13,820
Other noncertified DO	419,865	.58	53,050
Certified DO	19,667	.49	6,300
Total DOs†	207,849	.64	75,530
Noncertified groups	27,169	.16	431
Certified groups	112,644	.12	1,290
Total groups†	165,778	.15	4,210
MDs			
General practice	131,385	.38	21,810
Internal medicine	35,117	.23	2,010
Pediatrics	27,336	.16	300
Obstetrics/gynecology	7,092	.23	580
Surgery	37,783	.33	6,354
DOs			
General practice	139,357	.61	49,710
Internal medicine	2,505	.24	410
Pediatrics	6,036	.43	1,830
Obstetrics/gynecology	23,190	.86	10,280
Surgery	29,529	.65	10,910

* Includes only 358 providers giving 100 or more ambulatory visits in the first 2 years.

† Subsets do not add to total because total includes providers of unknown board certification status.

In interpreting the above findings, certain limitations in the data or methods must be considered. In particular, the question arises as to whether quality of care can be judged fairly without reference to the type of patient whom the physician encounters. This is especially important in populations that have less tradition of continuity of care with a single provider—e.g., the poor or the transient—because the physician may not see the patient again or the patient may not comply with complex (or even simple) medical regimens. Using antibiotic injections for patients in whom a bacterial diagnosis is only suspected may be more acceptable if the physician believes the patient may not return, may not get the appropriate laboratory work done (if it must be done elsewhere) or may not complete an oral medication regimen. For quality-of-care research or peer review based on claim forms, using criteria that depend on subtle factors of this sort is extremely difficult, but as PSROs take on ambulatory care review, the general issue should receive greater attention.

We should not be surprised to find that use of different types of injections differed by specialty—e.g., antibiotics by internists or hormones by obstetrician/gynecologists. Apart from differences arising from training and individual preferences, different types of physicians are at greater or lesser risk of giving an injection at all (because of patient and diagnostic case mix) and of giving an "inappropriate" injection (because of more- or less-strict guidelines for use). Interpretations about the quality of care delivered by different physician types thus should be made carefully.

Certain of these points were addressed in the next phase of the research. First, because changes in diagnostic case mix were not controlled for, we needed to determine whether diagnoses changed to fit the injection—i.e., whether physicians became sensitized to allowable diagnosis/injection combinations and began to use ones that were more acceptable from the point of view of EMCRO guidelines. This question was explicitly examined in the analyses reported in Chapter V.

Second, using a single criterion (use of medically unnecessary injections) as a measure of overall quality in the broad spectrum of primary care has obvious disadvantages in terms of its sensitivity and predictive validity. One would like to know, for example, if poorer practice behaviors as indicated by data on all injections will predict poor practice behaviors on other grounds as well. If so, this fact has important implications for implementation of the PSRO program, in that such "indicator" activities (injections in this case, but perhaps laboratory procedures or office visits elsewhere) might be used to identify physicians outside the mainstream of medicine who may need specific additional interventions or sanctions (such as 100 per cent review, more education, or restrictions on or removal from practice). Quality of care as judged by more sensitive and more valid criteria is examined as part of the episode analyses in Chapter VI.

Third, although we do not discuss the programmatic costs of ambulatory care review, we recognize the importance of whether quality assessment and assurance activities should be expected to pay their own way. The estimated dollar "savings" from injections prevented (which did not include any imputed value to iatrogenic or other side effects avoided) did not meet the operating expenditures of the EMCRO, and probably cannot be expected to.† In addition, peer review interventions along one dimension (e.g., use of injections) may lead to changes in practice behaviors along other dimensions, such as giving additional services of other types (e.g., prescription drugs, additional visits, or diagnostic tests). This "substitution effect" is dealt with (in nonmonetary terms) in the episode analyses reported in Chapter VI. Obviously, the total impact of peer review may be to increase expenditures on care at the same time it improves quality. In this situation, the "savings" from one aspect of the review effort cannot be expected to balance the higher costs of (presumably) better care. These considerations suggest that substantially greater conceptual and programmatic attention must be paid to the trade-offs between quality and cost in quality assurance efforts, especially as PSROs expand their ambulatory care review programs.

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† The gross and net savings to the Medicaid program for the EMCRO's review efforts were discussed in more detail elsewhere.[8]

IV. Antibiotics and Respiratory Infections: A Review of Relevant Literature

THE REMAINDER of this monograph focuses on antibiotic use in infectious diseases. Special attention is given to the use of intramuscular (IM) antibiotics in visits for respiratory infections and to use of both oral and IM antibiotics in entire episodes of common respiratory illnesses.

To provide a context in which to examine our methods and findings more thoroughly, we review here pertinent literature in use of antibiotic drugs in general and in selected respiratory conditions, indications and contraindications for common antibiotics, patterns of use by type of physician, and practices related to accurate diagnosis of these conditions.

Use of Antibiotics

Prevalence of Drug Use

Drugs have been administered by intramuscular (IM) injection for more than a century. Injections are commonly used to treat hospitalized patients. In 1976, for example, Greenblatt and Koch-Weser[27] reported that of 18,100 hospitalized patients in the United States who were monitored by the Boston Collaborative Drug Surveillance Program between 1966 and 1976, 52 per cent received at least 1 IM injection. Two years later, among 26,300 patients so monitored, 46 per cent received at least 1 IM injection; of the persons receiving injections, about 22 per cent received an antibiotic injection, over half of which were ampicillin.[26] The major reasons for using drugs in injectable form in the hospital setting are that the patient's disease or the pharmacokinetic properties of the drug preclude oral administration or make oral administration less effective; e.g., the patient may be vomiting or the drug may not be absorbed.

When outpatient use was surveyed, Alper[1] found that of an estimated 567.6 million office visits in the United States in 1975, 14 per cent involved the administration of an injection for therapeutic purposes and 5 per cent involved immunizations or desensitization shots. He asserted that IM injections are given in the office because physicians and patients believe that the "medication has been rapidly and completely deposited."[1] Yet many medications are absorbed as effectively orally and some medications are incompletely absorbed when given as an IM injection.

Most information about the use of antibiotics, in either oral or injectable form, is derived from hospital-based studies. In a survey of 20 randomly selected general hospitals in Pennsylvania, the Inter-Society Committee on Antimicrobial Drug Usage found that, while in the hospital, 28 per cent of patients received 1 antibiotic, 25 per cent received 2, 10 per cent 3, and 3 per cent 4 or more.[42] As in the Boston study, ampicillin was the antibiotic most frequently used, and cephalosporins were also used quite often. About 30 per cent of all antibiotics were given for prophylaxis to prevent infections in surgical procedures. Antibiotics used for prophylaxis should be stopped within 48 hours after the surgical procedure because of loss of efficacy. Yet 60 per cent of the patients had prophylaxis for more than 48 hours; extension of use beyond 48 hours accounted for 85 per cent of the use of antibiotics given for prophylaxis.

Findings similar to these have been documented by other observers in the past decade.[11,14,48,68,77,78] Many of them concluded that at least half of the antibiotics used in hospitals are associated with the following problems: use of the wrong drug, administration at the wrong dose, use for the wrong length of time, or inappropriate use for the illness for which it was given. Elimination of such practices might save a few hundred million dollars.[14,42] Concern about antimicrobial use in hospitals prompted the development of guidelines for such drugs by an interdisciplinary committee of the Veterans Administration.[47,48]

Little information is available concerning the use of antibiotics in outpatient medicine, and almost none about the use of injectable antibiotics. Data from the IMS America's National Prescription Audit of 800 retail pharmacies provide some estimate of the level of use of antibiotics at the time the EMCRO program was operating.[20] The numbers of prescriptions (in millions) written for common antibiotics in 1971 were as follows: tetracycline, 52.9; penicillin, 39.4; ampicillin, 24.5; erythromycin, 24.3; sulfonamides, 17.9; lincomycin and clindamycin, 4.1; cephalosporins, 2.2; and chloramphenicol, 0.9. In the next 2 years, use of cephalosporins increased 150 per cent, lincomycin and clindamycin 68 per cent, ampicillin 42 per cent, erythromycin 30 per cent, tetracycline 21 per cent and penicillin 15 per cent. Use of sulfonamides and chloramphenicol stayed about the same.‡ Simmons and Stolley[78] also reported on secular trends in antibiotic use; between 1954 and 1971, the growth in antibiotic use was greater than the population growth by about 60 per cent. In community studies of prescribing practices, antibiotics accounted for 15 to 20 per cent of all prescriptions; frequent problems with the use of antibiotics were observed, including prescribing antibiotics without cultures or without examining the patient, prescribing antibiotics for viral illnesses, prescribing chloramphenicol when an alternate agent was clearly available, and prescribing antibiotics prophylactically even in situations where the efficacy of such practices was questionable.

Similar distributions of prescription drugs have been observed in Medicaid programs. In New York, for example, 20 per cent of prescriptions filled for oral medications were for anti-infective agents; of these, 42 per cent were tetracycline, 21 per cent ampicillin and 15 per cent erythromycin.[73] In New Mexico, between 1971 and 1973, at least 27 per cent of all prescriptions were antibiotics; of these, 26 per cent were penicillin, 25 per cent ampicillin, 25 per cent tetracycline and 11 per cent erythromycin.

Use of Oral and Injectable Antibiotics in Outpatient Practice for Specific Diagnoses

The widespread use of antimicrobial agents in ambulatory care is related to the high incidence of infectious diseases. In summarizing this literature, Moffet[57] indicated that as many as 80 per cent of all illnesses in both adults and children are acute infections, and about 60 per cent of all infections are common respiratory illnesses. Among respiratory infections, about 25 per cent will be upper respiratory (e.g., pharyngitis), 55 per cent middle respiratory (e.g., bronchitis), 14 per cent pararespiratory (e.g., otitis media, sinusitus), and 6 per cent lower respiratory (e.g., pneumonia). The greatest misuse of antibiotics occurs in patients with upper and middle respiratory infections.

Most antibiotics used for treating respiratory infections have been in common use for 2 to 3 decades, yet information is sparse on how they are used or misused, especially in terms of respiratory infections. A description of some patterns of use of these drugs follows.

Two decades ago, among 410 persons seen mostly by private physicians for streptococcal infections or streptococcal carrier states, 55 per cent were treated with oral penicillin, 32 per cent with IM long-acting penicillin, 6 per cent with erythromycin, and 8 per cent (including 30 children under 10 years of age) with tetracycline. A significantly higher rate of cures was observed for those treated with penicillin (in either form) than for those treated with either of the other antibiotics.[84]

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‡ By 1977, however, declines in the use of tetracycline, chloramphenicol, lincomycin and clindamycin were well under way.

A decade later, a study of visits to general practitioners showed that of all patients with respiratory illness, 58 per cent were treated with oral antibiotics; of these, 40 per cent were penicillin, and 36 per cent tetracycline.[32] Patterns of antibiotic use varied by diagnosis; antibiotics were used to treat 18 per cent of patients with coryza, 37 per cent of those with influenza and 90 per cent of those with tonsillitis (penicillin was the drug of choice for 75 per cent of the cases of tonsillitis that were treated with antibiotics). The frequency of diagnosis of common respiratory illness, however, varied strikingly and unexpectedly among these practitioners. The authors concluded that an urgent need existed to define a respiratory illness in terms of its presenting signs and symptoms so that definitions of appropriate treatments for "objective respiratory syndromes" might be developed.

Stolley et al.[86] reported that about 95 per cent of physicians gave 1 or more prescriptions to patients with "common colds" (upper respiratory infections). Of these, about 60 per cent were for antibiotics, in particular penicillin and tetracycline. Kunin et al.[48] noted that in ambulatory care the most frequently used agents were broad- and medium-spectrum antibiotics (tetracycline, penicillin, erythromycin and lincomycin), most often for respiratory infections.

A high rate of antibiotic prescribing in a large urban group practice was evidently associated with more follow-up work for the physician (largely for changing antibiotics) and an above-average consultation rate for respiratory illness.[31] The number of "failures" of treatment (defined as either the need to prescribe an antibiotic within 2 weeks of a respiratory illness visit for which no antibiotic had been initially prescribed, or a change in antibiotic) was not systematically associated with a high or low rate of prescribing antibiotics.

Ray and his colleagues have extensively studied the use of prescription drugs in the Tennessee Medicaid population.[5,64–66,75] The parts of their work related to variations in antibiotic use by physician type are discussed later. In general, they reported excessively high use of chloramphenicol and tetracycline in office practice as well as a fairly high use of cephalosporins. For example, 205 physicians wrote 1,760 prescriptions for chloramphenicol for more than 990 patients between July 1973 and 1974; during 1976, 1,061 physicians wrote 11,500 prescriptions for cephalosporins for more than 7,000 ambulatory patients. Schaffner et al.[75] reported that after special-education mailings about chloramphenicol and tetracycline to each physician serving the Medicaid population, prescriptions for these 2 drugs diminished (although not necessarily because of the educational efforts). Ray et al.[65,66] analyzed tetracycline prescriptions in the Tennessee Medicaid population. Despite an explicit warning in the Physician's Desk Reference[63] about use of tetracycline in children under 8 years of age, more than 55 per cent of tetracycline syrup prescriptions and 96 per cent of tetracycline drops were for such children. For patients older than 8 years, 74 per cent of the tetracycline prescriptions were for upper respiratory infections (URI) and an additional 5 per cent were for pneumonia. Of the nearly 1,290 children younger than 8 years old who received tetracycline, 80 per cent received it in syrup form. Among a group of pregnant Medicaid patients, systemic anti-infectives were the most frequent prescription drugs apart from dietary supplements. Although these were mostly penicillins, a nontrivial number of recipients received tetracycline and 2 received chloramphenicol.[5]

Finally, Stott[87] examined the outcome of URI (coryza, nonspecific URI, tonsillitis or pharyngitis or both, and cough) among children 9 and younger seen by one of 7 physicians studied. Of the 965 children seen with a new URI episode, 40 per cent received an antibiotic. Among the 7 physicians, antibiotic use varied from 20 to 60 per cent. Of these 965 children, 24 per cent were seen again for the same or related diagnosis. Among this group were 61 true complications of the disease process, the majority of which related to the development of acute otitis media or lower respiratory tract infection. No correlation was observed between antibiotic use and number of complications, recall (return) rates or further infection.

Recommended Uses for Antibiotics

Several recent publications give detailed recommendations for proper use of antibiotics in certain diagnoses. In 1978, Eichenwald and McCracken[17,52] thoroughly reviewed antimicrobial therapy in children, which is especially relevant to this study of a Medicaid cohort, one-half of which is children. Their major recommendations and observations include the following: Cephalosporins should be used mainly for infections from gram-positive bacteria, especially when a child is allergic to penicillin and sufficiently ill to need hospitalization. The "widespread use" of these agents as "broad-spectrum" antibiotics has no logical or practical basis; "in particular, their relative inefficiency against H. influenzae argues against use in children with otitis media." Chloramphenicol should be limited to specific situations, such as typhoid fever, that occur very infrequently in a general population; it should not be used for middle and upper respiratory infections. Similarly, lincomycin and clindamycin should be restricted to unusual circumstances in which gram-positive disease cannot be treated by other less toxic antibiotics and to bacteroides and related anaerobic infections. Tetracyclines have very few uses in pediatric practice because of their side effects and because they are not very effective against common bacteria affecting children.

Penicillins as a group are the most generally useful class of antibiotics for infants and children. Penicillin G is the drug of choice for infections caused by, among other bacteria, beta-hemolytic streptococci. It is more effective, less toxic and less expensive than other antimicrobials that might be considered in such cases. Some penicillin preparations such as penicillin V are acid-stable (i.e., not destroyed by stomach acid) and thus are suitable for oral use. Others are resistant to breakdown by beta-lactamase, an enzyme present in many staphylococcal infections. The long-acting penicillins are effective in the treatment of beta-hemolytic streptococci infections and impetigo. The antistaphylococcal penicillins should be reserved for patients suspected of having a severe staphylococcal infection.

Erythromycin use is recommended principally for relatively self-limiting infections, especially those caused by beta-hemolytic streptococci (i.e., for ambulatory therapy of a streptococcal sore throat in a person allergic to penicillin). Ampicillin is a semisynthetic penicillin with a broader range than penicillin. It is effective against many strains of *Haemophilus influenzae,* a cause of otitis media in children.

Based on this type of information, the authors[17,52] state various diagnosis-specific recommendations. For example, for acute otitis media, ampicillin is preferred for young children; erythromycin/sulfa or penicillin/sulfa are also acceptable. Penicillin is preferred for older children. Acute sinusitis is usually treated with penicillin VK or ampicillin. For streptococcal pharyngitis, penicillin is the drug of choice, with erythromycin the preferred alternative for allergic patients. Because laryngopharyngitis is almost always caused by a viral agent, antimicrobial therapy is not effective; the exception would be *H influenza* infections in which case the child is toxic, usually hospitalized, and treated with IM ampicillin or chloramphenicol. For all these illnesses, lincomycin, clindamycin and cephalosporins should not be used routinely, and sulfonamides are not acceptable therapy. Antibiotic combinations are rarely indicated.

A series of articles in the British Medical Journal in 1978 detailed specific indications for use of antibiotics in a variety of conditions such as urinary tract infections, septicemia, surgical infections, and so on. In some cases, these articles dealt specifically with various types of antibiotics. Wise[94] reiterated that the drug of choice in infections caused by beta-hemolytic streptococci is penicillin. He made several points: 1) For oral penicillin, the acid-stable penicillin V is preferred to non–acid-stable penicillin G. 2) Oral penicillin V can be used alone in a mild infection, but should be combined with an injectable penicillin such as procaine or benzathine or both in a severe infection. 3) The penicillinase-stable penicillins should be reserved for staphylococcal infections. With respect to antibacterial activity, little difference is observed between ampicillin and amoxicillin; both are important in treating exacerbations of chronic bronchitis and otitis media, but should not be used in beta-hemolytic streptococcal infections because they are less effective and more prone to produce rashes. Reeves et al.[67] claimed that tetracycline could be considered at least an equal first choice for acute exacerbations of chronic bronchitis in adults, but should not be used for sore throats or soft tissue infections usually caused by streptococci or *Staphylococcus aureus*. Noone[60] stated that aminoglycosides (e.g., streptomycin, gentamicin) are not usually active alone against streptococci and should be used only rarely in non–life-threatening infections.

Several widely distributed publications contain recommendations that parallel those described above. The Manual of Acute Bacterial Infections[22] outlined current recommendations for antibiotic use based on the type of bacteria causing the disease and the type of drugs effective against specific bacteria. The Medical Letter on Drugs and Therapeutics[54] devoted a recent issue to the choice of antimicrobial drugs. Facts and Comparisons[43] is a compendium designed to provide a wide scope of drug information and to facilitate cost and clinical comparisons among drugs. Its sections on anti-infectives give details on actions, indications, contraindications, warnings and precautions, adverse reactions, and administration and dosage. The Physician's Desk Reference[63] similarly gives indications, contraindications, warnings, side effects, and dosage and drug form information.

Toxic Effects of Antibiotics

Common antibiotics such as penicillin, ampicillin, tetracycline and lincomycin can have major complications, which have been reviewed in special publications[95] as well as in the articles cited above. "Suprainfection," a phenomenon associated with many antibiotics (especially broad-spectrum drugs and aminoglycosides), manifests as a secondary infection that arises during antimicrobial therapy. Early observers asserted that it was a common problem, occurring in more than 2 per cent of patients receiving a chemotherapeutic agent; it was particularly frequent among patients being treated for pneumonia, otitis media, and pertussis, and among those receiving aminoglycosides, tetracyclines and chloramphenicol.[91] Later, it was claimed to be relatively rare.[92]

Few local complications are produced by an injection per se. Among 12,100 hospitalized patients who received at least 1 IM injection, only 48 developed a local complication to the injection: 15 had an abscess, 12 a local reaction (e.g., erythema) and 11 persistent pain.[26] Among 129 patients with strep pharyngitis treated with IM penicillin, however, about one-third had local reactions at the site of the injection.[84] One review noted that almost all classes of antibiotics would produce irritation, such as pain and erythema, at the site of administration.[95]

Most serious complications of injections relate to side effects of the drugs themselves, which can be severe and even life-threatening. About 5 per cent of patients are admitted to hospitals because of drug-induced illness.[21] More than 25 per cent of all hospitalized patients may experience an adverse drug reaction[50]; 10 to 30 per cent of hospitalized patients either experience or give a history of having experienced an adverse reaction to an antibiotic medication.[21]

Penicillin has low toxicity but has been associated with the following side effects: hypersensitivity (maculopapular eruptions), anaphylaxis, hemolytic anemia, leukopenia, thrombocytopenia, neuropathy and nephropathy. These reactions are rare, especially in doses administered to pediatric patients. For example, 2 to 3 per cent of people taking penicillin may develop a rash. Erythromycin is perhaps the least toxic antibiotic available, but in intramuscular form it is highly irritating and painful. Orally, the most common side effects are gastrointestinal disturbances and occasional mild allergic reactions.

Adverse reactions from ampicillin include the following: stomatitis, nausea, vomiting and diarrhea; hypersensitivity reactions; neuropathy; and nephropathy. About 8 per cent of those taking ampicillin develop a rash. These side effects are more likely to occur when the drug is given orally; very large doses given by injection may overexcite the nervous system, resulting in twitching or, rarely, seizures. Another adverse effect is suppression of normal gastrointestinal flora, permitting overgrowth of certain resistant organisms. For oral use, amoxicillin is definitely superior to ampicillin because it is as effective and produces distinctly fewer gastrointestinal side effects.

Tetracycline can result in vomiting, diarrhea, glossitis, maculopapular rashes, urticaria, anaphylaxis, and hemolytic and aplastic anemia. By far its most serious side effects, when used in late pregnancy and childhood to the age of 8 years, are permanent discoloration of teeth and, less commonly, enamel hypoplasia. Improper intravenous use of tetracycline may cause liver and renal necrosis and erratic or unpredictable blood levels. Tetracyclines have been shown to produce inhibition of bone growth in normal premature infants; in patients of all ages, some association has been shown with signs of increased intracranial pressure (pseudotumor cerebri). Finally, overgrowth of highly resistant organisms, producing vaginitis and proctitis, may also occur. One tetracycline in particular is associated with appreciable incidence of vertigo, dizziness and, rarely, hallucinations. The Committee on Drugs[13] of the American Academy of Pediatrics cited several articles on adverse reactions to tetracycline and reiterated that few, if any, reasons for using tetracycline in children younger than 8 years old can be advanced. Federal regulations against production of pediatric forms (syrups, drops) of tetracycline have been proposed.[18, 19]

Lincomycin can cause severe colitis which may end fatally. Other complications include aplastic anemia, mild to severe hypersensitivity reactions, tinnitus, and vertigo. Potentially serious toxic effects by either the oral or injectable route include, in addition to the foregoing, gastrointestinal disturbances, proctitis, vaginitis and jaundice. The sometimes-fatal colitis can develop weeks after the drug has been stopped. Clindamycin is basically associated with the same side effects as lincomycin.

Chloramphenicol has an enormous range of toxic effects, the most serious of which is aplastic anemia with pancytopenia; other side effects include skin rash, gastrointestinal reactions, neurologic damage and arrest of red cell maturation. In premature and young infants, cardiovascular collapse (gray syndrome) may occur.

Sulfonamides have a variety of toxic effects, including ones related to the kidneys, bone marrow depression, liver toxicity, various skin eruptions and photosensitivity, although these are rare. The most common adverse effects of sulfonamides are mild headaches, dizziness and rash. Renal toxicity can be reduced by using a "triple sulfa" preparation in place of a single sulfa preparation. The so-called "long-acting" sulfonamides are accompanied by an unacceptably high incidence of serious toxic reactions, in particular Stevens Johnson syndrome.

Several authors have commented on the use of antibiotics in combination and fixed doses. Combined antimicrobial therapy may, when used indiscriminately, increase the risks of severe infectious problems.[17] Presumably, these include emergence of resistant strains, higher risk of adverse reactions, overgrowth of organisms in the gastrointestinal and respiratory tracts, and possible neglect or delay in obtaining surgical or medical treatment. Fixed combinations of penicillin with other drugs may be unjustified except when specific synergistic effects are intended or when an infection is definitely caused by more than 1 pathogen.[94]

Summary

Antibiotic use is widespread in both hospital and ambulatory settings. Many viral infections are treated with antibiotics; in these instances, their use is questionable. Tetracycline should not be used in children less than 8 years old or in streptococcal infections. Lincomycin and clindamycin have almost no place in ambulatory care, and certainly not for the conditions under study here. The antibiotic of choice for common respiratory complaints, especially those caused by beta-hemolytic streptococci, is penicillin, with erythromycin as an acceptable alternative for patients allergic to penicillin. In otitis media, ampicillin or amoxicillin is the therapy of choice; sulfonamide in association with penicillin or erythromycin is an appropriate alternative, or in some practices even the drug of choice, because of the occurrence of resistant strains of *H. influenzae*. When the IM route for an antibiotic is desirable, penicillin G benzathine ("long-acting" penicillin) is preferable to multiple injections of penicillin procaine or other short-acting penicillins.

The Relationship Between Physician Characteristics and the Choice of Therapeutic Agents

The major studies of the relationship between physician characteristics and prescribing habits are summarized in Table 4.1. The most striking fact may well be how few studies have been performed. Knowledge is limited about the association between physician characteristics and the appropriateness of drug use. Although some correlation may exist between better prescribing behavior and treating diseases for which one was trained (i.e., being a "modal" specialist), advanced training of any sort, or being a recent graduate from medical school, these findings must be interpreted with caution, because little variance in prescribing behavior is predicted by the physician characteristics that have been studied.

The need to improve physician knowledge about the use of antibiotics also is important. For example, one "hopefully biased" pilot survey documented that in a majority of cases, physicians did not know the number of individual drugs in combination medications that they often prescribed and did not know the correct makeup of those drugs.[3] Results from the National Antibiotic Therapy Test (NATT) indicated a general lack of knowledge about how to use antibiotics, of drug–drug interactions, drug side effects and principles of bacteriology.[59] For instance, on an item about shifting from penicillin to another antibiotic as treatment for Group A beta-hemolytic streptococcal disease if the patient failed to respond within 48 hours, 43 per cent of physicians indicated they would switch drugs even though the correct answer was not to change. Good test scores correlated positively with a high volume of inpatient visits. In general, most physicians scored better on questions that related to their specialties, but surgeons and family practitioners scored lower than internists and pediatricians.

The NATT questions were about clear-cut therapeutic situations. In many medical situations, however, the correct diagnosis may be unknown and the appropriate mode of therapy may be debatable. In these situations, antibiotics are often used without cultures, sensitivity tests or clinical indications.

In a study of 1,035 admissions to a 500-bed nongovernmental community hospital, 36 per cent of patients were treated for infection; a team of reviewers concluded that 66 per cent of the therapies were "irrational" and 13 per cent were "rational."[68] Of the 223 therapies judged irrational, 112 (50 per cent) did warrant antimicrobial therapy; however, the therapy of choice was inappropriate. In 111 (50 per cent), no antimicrobial was necessary; 92 per cent of these patients lacked any clinical evidence of infection. Although cultures were ordered for 164 patients (74 per cent), only 49 per cent of the patients given irrational therapies were cultured; 57 per cent of the rational therapy group were cultured.

These types of findings call into question the therapeutic judgment of the physicians studied. If physicians ignore laboratory and clinical data in making decisions, or do not use the laboratory appropriately, it will be almost impossible to resolve genuine issues of therapeutic controversy, such as the treatment of sore throat.

Controversies About Appropriate Management of Common Respiratory Infections

Strep Throat

Controversy about diagnosis and treatment of strep throat, or strep pharyngitis, illustrates the uncertainty often facing physicians in managing patients who present with a sore throat. The question is whether a person with a sore throat should be treated with an antibiotic on the assumption that the inflammation has a bacterial (i.e., streptococcal), not a viral, cause. Strep throat can be treated successfully by antibiotics; if it goes untreated, however, it can result in diseases such as acute glomerulonephritis (kidney disease), acute rheumatic fever and heart disease. A viral sore throat does not respond to antibiotics; treatment with an antibiotic exposes a patient to potential side effects with no concomitant benefits.

The main controversies center on the accuracy of the diagnosis in the absence of a throat culture and on the justification for beginning antibiotic therapy without the benefit of the throat culture results. Without a throat culture, in most circumstances an experienced physician has a 50 per cent chance of predicting which sore throat will be positive for beta-hemolytic streptococcus.[90] During epidemics of strep pharyngitis, an experienced physician will be correct 75 per cent of the time.[88]

The diagnostic problem is actually more complex than this, because as many as 13 per cent of patients who have strep throat and presumably would have a positive throat culture may have a negative result (for a variety of technical reasons) if only one culture is done.[83] Moreover, some persons with positive cultures do not have raised antistreptolysin O titers, which suggests they are transient or chronic carriers of streptococcus and do not have active streptococcal infection that would require antibiotic treatment. In one study, for example, more than half of the patients for whom streptococci were initially cultured demonstrated no subsequent rise in antibodies.[41]

One report suggested that "quantitative assessment of the numbers of streptococci isolated on culture" is necessary to distinguish between carriers and infected persons; the diagnosis of active strep pharyngitis requiring treatment would be

TABLE 4.1 Summary of Major Findings on Use of Oral and Intramuscular Medications and Physician Characteristics

Author	Main Topic of Study	Source of Data	Physician Specialties	Patient Population	Major Findings
Coleman, Katz, & Menzel, 1957[12]	Use of new drugs	Questionnaire	All	Outpatient and inpatient	Positive relationship between use of new drugs and number of informal relationships with other physicians.
Ministry of Health, United Kingdom, 1964[56]	Relationship of physician characteristics to physician prescription habits	Prescription records	All	Outpatient	Inverse relationship between physician prescribing rate and size of patient panel. No relationship between prescription rate and type of medical school.
Joyce, Last & Weatherall, 1967[36]	Relationship between personal characteristics of physicians and differences in prescribing habits	Interview	General practice	Outpatient	Positive relationship between appropriate use of drugs and advanced postgraduate training and whole person orientation.
Meade, 1967[53]	Prescribing of chloramphenicol and physician characteristics	Interview	General practice	Outpatient	No relationship between appropriateness of chloramphenicol use and medical education, years of medical education, views about prescribing medications or about role of general practice.
Stolley, Becker, Lasagna et al. 1972[85]	Appropriateness of prescribing habits	Interview; questionnaire	Predominantly general practice	Outpatient and inpatient	Positive relationship between appropriate use of drugs and special postgraduate training, recent graduation from medical school, whole person orientation. Inverse relationship with age; time in practice. No relationship with type of medical school.
Payne, 1976[62]	Physician prescribing habits	Survey	All	Outpatient and inpatient	Positive relationship between appropriateness of physician prescribing habits and training in primary care specialties, practice of "modal" specialty.

Brook & Williams, 1976[7]	Relationship of appropriateness of use of injections and professional/ personal characteristics	Medicaid claims data	New Mexico physicians (mainly primary care)	Outpatient (Medicaid recipients)	Positive relationship between appropriateness of injection use and certification status, group practice and pediatrics. Inverse relationship with training in osteopathy, gynecology. Little or no relationship with physician age, medical education in foreign school.
Ray, Federspiel & Schaffner, 1976[64]	Prescribing of chloramphenicol in ambulatory practice	Review of prescriptions (Medicaid data)	Tennessee physicians	Outpatient (Medicaid recipients)	Inverse relationship between appropriateness of chloramphenicol prescribing and rural practice and family practice. No relationship with physician age. Small percentage of doctors prescribed much of the chloramphenicol.
Ray, Federspiel & Schaffner, 1977[65]	Prescribing of tetracycline in ambulatory practice	Review of prescriptions (Medicaid data)	Tennessee physicians	Outpatient (Medicaid recipients)	Inverse relationship between appropriateness of tetracycline prescribing and rural practice and family practice. A small percentage of doctors prescribed much of the tetracycline. Internists and surgeons prescribed more tetracycline to children ≤8 years old than other specialists.
Schaffner, Ray & Federspiel, 1978[75]	Prescribing of antibiotics in ambulatory practice	Medicaid data	Tennessee physicians	Outpatient (Medicaid recipients)	Decreases in use of chloramphenicol and tetracycline. Little overlap between physicians who used either or both of those 2 drugs and those who used cephalosporin.

associated with heavy growth of streptococci.[2] Such a quantitative culture is almost never obtained by practicing physicians.

Experts disagree as to the appropriate work-up for a patient presenting with a sore throat. Some recommend throat cultures for all patients with a sore throat or for all "symptomatic" patients.[57] Others would do cultures on patients with sore throats who show any fever (99.1° F or higher) or in all persons with fever higher than 101° F, regardless of the presence or absence of a sore throat.[30] Still others suggest a culture on all children with a temperature of 101° F or higher, with or without the complaint of sore throat.[90] Several articles have outlined clinical "syndromes" often associated with positive strep cultures.[41, 55, 83, 89]

One expert on streptococcal disease has asserted that throat cultures are needed (together with clinical and epidemiologic findings) to increase the accuracy of diagnosis of strep throat.[90] Others have argued that strep pharyngitis is "best defined" by a throat culture; because treating undifferentiated viral upper respiratory infections with antibiotics produces no benefit and may have side effects in as many as one-third of people taking antibiotics, they suggested that antibiotics be used carefully.[81]

One group used a decision analysis model to estimate the cost-effectiveness of various strategies to prevent acute rheumatic fever by treating pharyngitis with an antibiotic. Results indicated that, under epidemic situations, all nonallergic patients with pharyngitis should be treated with penicillin.[88] Under endemic circumstances, the decision to treat should be based on the probability—derived from clinical findings—that the throat culture would be positive; all persons with a 30 per cent or greater chance of a positive culture should be treated without the culture, and all persons with a 5 per cent chance or less should not be cultured or treated. Those in between should receive a throat culture before the therapeutic decision is made. As one example, adults with tender cervical nodes, temperature of 100.4° F or higher, pharyngeal exudate and no cough should be treated without waiting for culture results.

Komaroff[46] elucidated a strategy for sore throat management that recommended the following actions: throat culture in all persons between 5 and 25 years of age regardless of clinical findings and in all people older than 25 when certain signs and symptoms are present (e.g., temperature $\geq$ 100° F, exudate, tender anterior cervical nodes or scarlatiniform rash). Treating before results of the throat culture are known would be justified in the following situations: known epidemic of nephritogenic streptococci, presence of scarlatiniform rash, past history of rheumatic fever or diabetes, and simultaneous presence of temperature $\geq$ 100° F, exudate, and tender anterior cervical nodes.

Various advantages to early penicillin treatment without the benefit of throat cultures (defined variously as within the first 24 or 48 hours) have been claimed: reduction in morbidity in first 24 hours[55]; a decrease in illness duration[88]; less chance of spreading disease to close contacts[46, 88]; lower money and time costs to the patient[88]; greater effectiveness in preventing acute rheumatic fever (the most feared late complication of a strep infection)[88]; and possible identification of patients with false-negative throat cultures.[55] Some of these claims are disputed; various authors have claimed that early treatment is not likely either to alter the clinical course of the disease[46, 81, 90] nor to prevent acute glomerulonephritis.[46, 81] Because prevention of acute rheumatic fever can be accomplished when treatment is begun within the first 9 days,[46, 81] waiting for the results of a throat culture before initiating treatment would seem to be safe. Wannamaker[90] argued that delaying penicillin therapy might well prevent cost, pain and risk of sensitization.

Otitis Media

Similar controversies exist regarding appropriate diagnostic and therapeutic practices for acute or chronic otitis media. Although there is general agreement that penicillin is the drug of choice for otitis media caused by pneumococcus or streptococcus and that ampicillin, amoxicillin, or combinations of penicillin or erythromycin with sulfonamides are appropriate for *H. influenzae* infections,[33,34,52] some[82] assert that penicillin and sulfonamides do not produce better clinical results than penicillin alone. Moreover, many centers are reporting an increased incidence of otitis media caused by ampicillin-resistant strains of *H. influenzae*. For example, 87 per cent of all cases in one area were ampicillin-resistant.[76] Some question also arises as to whether tetracycline is an appropriate therapy even for children younger than 8 years of age in *H. influenzae* infections that are resistant to ampicillin.[44,45] With respect to diagnosis, various authors have noted that needle aspiration is the only way to establish the identity of the bacterium causing otitis media, but not all agree, apparently, as to whether it is warranted in ordinary outpatient practice. Bluestone and Shurin[4] discussed many of these issues regarding middle ear disease.

Some authors have asserted that nasopharyngeal and throat cultures are valuable in determining the cause of otitis media; nasopharyngeal cultures are much easier to obtain than needle aspirations of middle ear fluid. In fact, a 72 per cent agreement has been reported between semiquantitative nasopharyngeal cultures and cultures of middle ear fluid.[76] Because only 3 per cent of physicians surveyed reported performing myringotomies (fluid obtained from the middle ear for culture) for acute otitis media, instituting "rational" antimicrobial therapy based on precise knowledge of the infectious agent would be difficult.

Moscovice[58] noted in his study of episodes of respiratory infections that the preferred antibiotic in acute otitis media for the Frontier Nursing Service was penicillin plus sulfa for children younger than 5 years and penicillin for patients older than 5. Decongestants (such as pseudephedrine) or antihistamines (such as diphenhydramine or Benadryl) are also to be given. Other authors have claimed that use of oral decongestants in acute otitis media is a widespread practice, although Stickler et al.[82] reported that administration of pseudephedrine did not improve the outcome of acute otitis media in their clinical trial. Olson et al.[61] reported on a randomized double-blind study of children treated for otitis media with antibiotics and either pseudephedrine or placebo. They concluded that no benefit was gained from the pseudephedrine in terms of preventing serous otitis media or treating it once it had occurred. Interestingly, these authors noted "there are no comprehensive clinical criteria for acute otitis media in the literature."

Comment

These unresolved questions as to appropriate steps in diagnosis and therapy illustrate one set of problems in peer review. Making judgments about diagnosis and therapy are difficult when experts cannot agree on correct courses of action. This problem is mitigated because experts do agree that such symptoms should be treated with organism-specific antibiotics that minimize side effects. In general, bacterial infections should be treated neither with more than 1 class of antibiotic, to protect the patient from exposure to risks from 2 different drugs and potentially synergistic toxic effects, nor with antibiotics that are potentially more toxic than required.

V. Relationships Among Diagnoses, Injections and Physician Characteristics

THE RESEARCH reported so far covered changes in use of intramuscular (IM) medicines over time as a function of the peer review system, the characteristics of physicians who gave the injections, and the type of injection given. The next stage of the research, which added diagnosis to the analyses, was restricted to antibiotic injections, for three reasons. First, use of antibiotic injections was widespread and represented about 50 per cent of all injections given during the period of this study. Second, the EMCRO diagnosis-specific criteria for use of antibiotics were more specific than criteria for use of other commonly provided injections, such as antihistamines, steroids, or antiemetics. Third, antibiotics have potentially serious side effects.

Research Questions

We selected several topics for investigation in this phase of the study: 1) Will peer review prompt physicians to change the diagnoses they record on claim forms, to justify use of antibiotic injections? If a shift in diagnoses takes place, will physicians who originally gave poor care in Period I (as defined by injection criteria) demonstrate a greater shift than physicians who gave average or good care? Will such physicians attribute more patient visits to diagnoses that might be treated with antibiotic injections as allowed by the EMCRO guidelines? 2) Can certain diagnosis/injection combinations be targeted for focused review because they highlight differences between appropriate and inappropriate care, e.g., streptococcal sore throat and long-acting (LA) penicillin or upper respiratory infection (URI) and lincomycin? 3) Will primary-care specialists in internal medicine and pediatrics use antibiotic injections more appropriately for respiratory symptoms than will gynecologists, surgeons or general practitioners? 4) Do physicians use different types of antibiotic injections interchangeably, regardless of diagnosis, or do they specifically use different types of antibiotic injections for different diagnoses? 5) Will peer review reduce the treatment of viral illnesses with antibiotic injections?

Methods

The new element in the analyses reported in this chapter was diagnosis. We grouped diagnostic categories according to 4-digit HICDA-I codes, and selected 24 groupings on the basis of the frequency with which they were treated with antibiotic injections. The categories were ranked from most- to least-likely to be bacterial (rather than viral) in etiology and thus most to least appropriately treated with antibiotic injections (Table 5.1). Rankings were based on a review of the literature and the judgment of 3 internists and 2 pediatricians that the disease has a bacterial rather than a viral etiology; for example, pelvic inflammatory disease, a bacterial diagnosis for which antibiotics are highly recommended, was ranked higher than gastritis, a disease for which antibiotics would not be appropriate. The physicians ranked the diagnoses independently; final rankings were arrived at through discussion. Although the internal ordering of closely ranked diagnoses may be debatable, diagnoses at the top of the spectrum are clearly most often bacterial in origin, and those at the bottom most often viral.

Ranking diagnoses was necessitated by the nature of the Medicaid claims data. On all claim forms for office visits and injections submitted for reimbursement, the

TABLE 5.1. Infectious Disease Categories and Corresponding HICDA-I Codes Ranked in Order from "Most Bacterial" to "Most Viral" in Origin

Ranking from Most to Least Bacterial in Etiology	HICDA-I Code	Name of Diagnostic Category
1	34.0	Streptococcal sore throat
2	612.0–614.9 616.0	Pelvic inflammatory disease
3	98.0– 98.9	Gonococcal infection
4	590.1–590.9	Pyelonephritis
5	381.0–381.9	Otitis media
6	680.0–684.9 686.0–686.9	Skin infection (including cellulitis and impetigo)
7	461.0–461.9 503.0–503.9	Sinusitis
8	481.0–486.9	Pneumonia (bacterial)
9	462.0–462.9 463.0–463.9	Pharyngitis/tonsillitis
10	595.0–595.9 599.9	Cystitis (including urinary tract infection)
11	870.0–897.9	Laceration; open wound
12	489.0–491.9	Bronchitis
13	464.0–464.9	Laryngitis (including tracheitis)
14	9.1– 9.2	Diarrhea; gastroenteritis
15	360.0	Conjunctivitis
16	622.1	Vaginitis
17	788.8	Fever of unknown origin
18	500.0–500.9	Hypertrophy of tonsils
19	470.0–470.9	Influenza
20	460.0–460.9 465.0–465.9	Acute upper respiratory infection (URI)
21	783.3	Cough
22	535.0–535.9	Gastritis
23	784.1	Nausea/vomiting
24	519.9	Mediastinitis

physician listed a primary and (sometimes) a secondary diagnosis. For claims with 2 diagnoses, a rule was needed by which to assign the service uniquely to 1 diagnosis: the operative rule was that the service be assigned to the most "bacterial" diagnosis in the list. For example, a visit with the dual diagnoses strep throat and URI was counted as a visit for strep throat; similarly, if the claim form for a visit and an ampicillin injection contained the diagnoses otitis media and URI, both the injection and the visit were assigned to otitis media. This hierarchical rule avoided double-counting diagnoses and visits, gave the physician the benefit of the doubt in use of IM antibiotics, and prevented using a "primary" diagnosis that was inaccurate for purposes of these analyses.

Certain analyses were performed only on selected diagnostic categories. For instance, a subset of upper and lower respiratory tract infections were distinguished as to whether they were likely to be bacterial or viral in origin and then aggregated into 2 categories. The bacterial respiratory infections were strep throat, pharyngitis/tonsillitis, otitis media, sinusitis, and pneumonia, and the viral diagnoses were bronchitis, cough, laryngitis, and acute URI.

Physician characteristics studied were type of practice (group and solo practice), type of provider, (Doctor of Medicine

[MD] or Doctor of Osteopathy [DO]), board certification status (certified, non-certified), outlier status (as defined in Chapter I), and specialty (general practice, internal medicine, pediatrics, general surgery, and obstetrics/gynecology). Analyses in this phase were restricted to the use of antibiotic injections, especially short-acting (SA) penicillin, lincomycin, ampicillin, tetracycline and long-acting (LA) penicillin (benzathine).

As in earlier chapters, 3 rates of use of antibiotic injections for different diseases or for different physician characteristics were calculated for Periods I and II* as the dependent variables: the billed-per-visit rate (number of injections billed per ambulatory visit), the denied-per-visit rate (number of injections whose payment was denied per ambulatory visit), and the denied-per-billed rate (the number of injections for which payment was denied divided by the number billed). Changes in the first of these dependent variables over time were used to clarify relationships among diagnoses, physician characteristics, and use of antibiotic injections.

Results

Treatment of Infectious Diseases by Type of IM Antibiotic

All Infectious Diseases. The 24 diagnoses, ranked by number of visits in Period I in Table 5.2, represented almost 60 per cent of all ambulatory visits and more than 90 per cent of the antibiotic injections in both periods. In Period I, the top 10 diagnoses (acute URI, pharyngitis/tonsillitis [hereafter pharyngitis], bronchitis, otitis media, diarrhea, cystitis, influenza, skin infection, laceration and strep throat) accounted for 50 per cent of visits and 79 per cent of antibiotic injections. In Period II, the rank ordering and percentage of visits attributed to these diagnoses changed slightly. For example, pharyngitis replaced acute URI as the most common diagnosis. The percentage of visits attributed to acute URI, bronchitis, otitis media, and influenza decreased; the percentage attributed to strep throat, sinusitis, and cystitis increased. Generally speaking, however, the proportion of all ambulatory care visits in the Medicaid population accounted for by the same common infectious diseases remained constant.

For these 24 diagnoses, the billed-per-visit rate for injectable antibiotics decreased from 0.24 in Period I to 0.08 in Period II (see the last 2 columns of Table 5.2). In Period I, visits for strep throat, pharyngitis, pneumonia, bronchitis, and influenza were treated at least 50 per cent of the time with injectable antibiotics. Visits ascribed to various other respiratory infections also involved significant numbers of antibiotic injections, including 0.46 for laryngitis, 0.39 for acute URI, and 0.29 for cough. By Period II, the number of antibiotic injections given to treat these diseases had decreased markedly. The only diagnosis still managed primarily with injectable antibiotics in Period II was strep throat (billed-per-visit rate of 0.60).

Typical Infectious Diagnoses. Patterns of injection use were studied in greater depth for 8 diagnoses: acute URI, pharyngitis, bronchitis, otitis media, diarrhea, cystitis, influenza, and strep throat. Of these, 4 (strep throat, pharyngitis, cystitis, and otitis media) have a high probability of having a bacterial cause; the other 4 are commonly considered viral. Data on 2 diagnoses from the "bacterial" group and 2 from the "viral" group (see Table 5.3) are discussed below.

Strep throat: The number of visits for strep throat increased about 30 per cent between Periods I and II. As a percentage of all visits, strep throat went from 1.6 to 2.0 per cent. During Period I, an IM antibiotic was used in 63 per cent of the visits for strep throat. Of these injections, 56 per cent

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* As before, Period I was September 1971 through January 1972, before active peer review of injections; Period II was September 1973 through January 1974.

TABLE 5.2. Number and Percentage of Ambulatory Visits, Percentage of Antibiotic Injections, and Injections Billed per Visit for 24 Selected Diagnoses, Periods I and II

	Ambulatory Visits				Percentage of Antibiotic Injections†		Injections Billed Per Visit	
	Period I		Period II		Period I	Period II		
Diagnosis*	Number	Per Cent	Number	Per Cent	(N = 17,100)	(N = 6,900)	Period I	Period II
Acute URI	6,900	11	5,700	8	16	7	.39	.09
Pharyngitis	6,500	10	7,400	10	22	29	.56	.27
Bronchitis	5,300	8	5,100	7	16	9	.52	.13
Otitis media	3,000	5	3,100	4	8	10	.45	.23
Diarrhea	2,400	4	3,500	5	3	3	.23	.05
Cystitis	1,900	3	2,400	3	2	2	.21	.04
Influenza	1,700	3	1,100	2	5	2	.50	.12
Skin infection	1,400	2	1,400	2	2	3	.31	.13
Laceration	1,400	2	2,100	3	1	1	.09	.03
Streptococcal sore throat	1,200	2	1,600	2	4	14	.63	.60
Pneumonia	900	1	1,100	2	3	3	.54	.19
Sinusitis	900	1	1,300	2	2	3	.44	.17
Gastritis	800	1	1,000	1	< .005	< .005	.04	.01
Vaginitis	600	1	900	1	< .005	< .005	.12	.03
Pelvic inflammatory disease	500	1	600	1	1	1	.34	.10
Laryngitis	500	1	500	1	1	1	.46	.20
Conjunctivitis	400	1	600	1	< .005	< .005	.14	.03
Pyelonephritis	400	1	600	1	1	1	.39	.07
Nausea	300	< .005	500	1	< .005	1	.14	.06
Fever of unknown origin	300	< .005	1,000	1	1	1	.37	.10
Hypertrophy of tonsils	300	< .005	200	< .005	1	< .005	.44	.08
Mediastinitis	300	< .005	200	< .005	1	< .005	.38	.03
Gonococcal infection	100	< .005	200	< .005	< .005	1	.49	.36
Cough	100	< .005	300	< .005	< .005	< .005	.29	.08
Total‡	38,000	59§	42,300	59§	91‖	93‖	.24	.08

* Rank-ordered by number of ambulatory visits in Period I.

† Denominator was total antibiotic injections. There were 17,100 antibiotic injections in Period I and 6,900 in Period II. Acute URI, for example, had 2,700 injections in Period I, which is 16 per cent of 17,100; Fever of unknown origin had 100 injections in Period II, which is 1 per cent of 6,900.

‡ Totals do not add because of rounding.

§ Denominator was total visits.

‖ Does not include categories of "other infectious diseases" and "all other diseases."

TABLE 5.3. Number of Ambulatory Visits and Injections, and Injections Billed per Visit, for the 5 Most Common Antibiotics and 8 Selected Infectious Diseases, Periods I and II

			Penicillin		Lincomycin		Ampicillin		Tetracycline		Bicillin	
Diagnosis*	Number of Visits	Number of Antibiotic Injections	Number of Injections†	Billed Per Visit	Number of Injections	Billed Per Visit	Number of Injections	Billed Per Visit	Number of Injections	Billed Per Visit	Number of Injections	Billed Per Visit
Period I												
Acute URI	6,900	2,700	1,770	.26	400	.06	60	.01	260	.04	190	.03
Pharyngitis	6,500	3,700	2,110	.32	920	.14	70	.01	180	.03	370	.06
Bronchitis	5,300	2,800	1,180	.22	1,120	.21	70	.01	260	.05	100	.02
Otitis media	3,000	1,300	540	.18	320	.11	110	.04	50	.02	310	.10
Diarrhea	2,400	600	180	.08	60	.02	30	.01	240	.10	20	.01
Cystitis	1,900	400	160	.08	60	.03	20	.01	150	.08	10	< .005
Influenza	1,700	900	330	.19	260	.15	20	.01	200	.12	60	.03
Streptococcal sore throat	1,200	700	390	.33	180	.15	< 5	< .005	20	.01	140	.12
Total	28,900	13,100	6,660	.23	3,320	.11	380	.01	1,360	.05	1,200	.04
Period II												
Acute URI	5,700	500	320	.06	30	.01	10	< .005	30	.01	90	.02
Pharyngitis	7,400	2,000	640	.09	100	.01	40	.01	50	.01	1,140	.15
Bronchitis	5,100	600	260	.05	60	.01	30	.01	50	.01	230	.04
Otitis media	3,100	700	190	.06	30	.01	60	.02	10	< .005	420	.14
Diarrhea	3,500	200	90	.02	10	< .005	20	< .005	10	< .005	40	.01
Cystitis	2,400	100	40	.02	10	< .005	20	.01	10	< .005	20	.01
Influenza	1,100	100	70	.06	20	.01	< 5	< .005	10	.01	30	.03
Streptococcal sore throat	1,600	1,000	220	.14	40	.03	10	< .005	10	< .005	690	.43
Total	29,900	5,200	1,830	.06	300	.01	190	.01	180	.01	2,660	.09

* Ranked according to number of visits in Period I.

† Numbers were rounded for presentation; percentages were calculated on the basis of actual, not rounded, numbers.

were SA penicillin, 26 per cent lincomycin, 20 per cent LA penicillin, 3 per cent tetracycline, and the remainder ampicillin, other antibiotics or various antibiotic combinations. In Period II, 60 per cent of strep throat visits involved an antibiotic injection: the preferred antibiotics were LA and SA penicillin (69 and 22 per cent), respectively, and lincomycin was no longer used.

Pharyngitis: Pharyngitis constituted about 10 per cent of all visits in both periods. The EMCRO review guidelines permitted certain antibiotics as a treatment for pharyngitis, consistent with the belief that the diagnosis of pharyngitis might be used interchangeably with the more specific diagnosis of strep throat and that some people with pharyngitis might in fact have a streptococcal infection. The percentage of visits for pharyngitis associated with an antibiotic injection of any type fell from 56 to 27 per cent between the 2 periods. In Period I, SA penicillin made up 57 per cent of all antibiotic injections for this diagnosis, lincomycin about 25 per cent, and LA penicillin 10 per cent. In Period II, pharyngitis was seldom treated with lincomycin or any other antibiotic except LA or SA penicillin (57 and 32 per cent).

Bronchitis: Bronchitis made up approximately 8 per cent of all visits in Period I and 7 per cent in Period II. In the former, 52 per cent of the visits resulted in an antibiotic injection; in the latter, only 13 per cent. In Period I, SA penicillin and lincomycin were used with equivalent frequency (42 and 40 per cent, respectively, of all antibiotic injections for bronchitis); tetracycline was another 9 per cent. In Period II, use of antibiotic injections was confined almost entirely to SA and LA penicillin (43 and 38 per cent, respectively, of the small number given).

Acute URI: Acute URI was responsible for 11 per cent and 8 per cent of all visits in Periods I and II; 39 per cent of Period I visits and 9 per cent of Period II visits were treated with injectable antibiotics. Of the Period I injections, 66 per cent were SA penicillin, 15 per cent lincomycin, 10 per cent tetracycline, and 7 per cent LA penicillin. In Period II, the distribution was as follows: 64 per cent SA and 18 per cent LA penicillin and 6 per cent (each) lincomycin and tetracycline.

Summary: These 4 diagnoses accounted for just under 60 per cent of the IM antibiotics in both periods. For each diagnosis, lincomycin was heavily used in Period I and appeared to be the physician's second drug of choice. By Period II, use of injectable antibiotics had fallen dramatically for acute URI, pharyngitis and bronchitis, and remained the same for strep throat. Use of lincomycin was cut drastically, and the antibiotic of choice for both pharyngitis and strep throat became LA penicillin. These changes were all consistent with EMCRO guidelines.

Use of Injectable Antibiotics by Diagnosis

This section gives the diagnoses for which 5 antibiotics (LA and SA penicillin, ampicillin, lincomycin, and tetracycline) were used and describes changes between the 2 periods. Because the EMCRO intended to curtail drastically the use of lincomycin, tetracycline and SA penicillin, and to promote use of LA penicillin when IM antibiotics were required, these are given the most attention.

Injections of ampicillin were rarely used in either period. Its greatest use was in otitis media (21 and 25 per cent, respectively, of all visits in Periods I and II). It will not be considered further in this section.

Short-Acting Penicillin. Of the 17,100 antibiotic injections given in Period I, more than 8,600 (50 per cent) were SA penicillin; these were primarily used for pharyngitis (24 per cent), acute URI (21 per cent), and bronchitis (14 per cent) (Table 5.4). In Period II, the number fell to 2,500 (36 per cent of all IM antibiotics), chiefly for the same 3 diagnoses plus strep throat and otitis media. The billed-per-visit rates

TABLE 5.4. Number and Per Cent of Ambulatory Visits and Short-Acting Penicillin Injections, and Injections Billed per Visit, by Diagnosis, Periods I and II

	Ambulatory Visits				Short-Acting Penicillin Injections					
	Period I		Period II		Period I		Period II		Period I Billed/ Visit	Period II Billed/ Visit
Diagnosis*	Number†	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent		
Pharyngitis	6,500	10	7,400	10	2,110	24	640	25	.32	.09
Acute URI	6,900	11	5,600	8	1,770	21	320	12	.26	.06
Bronchitis	5,300	8	5,100	7	1,180	14	260	10	.22	.05
Otitis media	3,000	5	3,100	4	540	6	190	8	.18	.06
Streptococcal sore throat	1,200	2	1,600	2	390	4	220	9	.32	.14
Influenza	1,700	3	1,100	2	330	4	70	3	.19	.06
Skin infection	1,400	2	1,400	2	250	3	80	3	.18	.06
Pneumonia	900	1	1,100	2	240	3	80	3	.27	.08
Diarrhea	2,400	4	3,500	5	180	2	90	3	.08	.03
Cystitis	1,900	3	2,400	3	160	2	40	2	.08	.02
Subtotal	31,200	49	32,300	45	7,150	83	1,990	78	.23	.06
All others	32,700	51	39,700	55	1,490	17	550	22	.05	.01
Total‡	63,900	100	72,000	100	8,640	100	2,540	100	.14	.04

* Ranked according to number of short-acting penicillin injections in Period I.

† Numbers were rounded for presentation; percentages were calculated on the basis of actual, not rounded, numbers.

‡ Totals may not add because of rounding.

for all SA penicillin injections were 0.14 and 0.04 in the 2 periods. Declines in use occurred across all diagnostic categories, particularly in diseases of viral etiology.

Lincomycin. More than 4,300 injections of lincomycin were given in Period I (25 per cent of all IM antibiotics) (Table 5.5). Five diagnoses (bronchitis, pharyngitis, acute URI, otitis media, and influenza) accounted for about 70 per cent of these injections. In fact, bronchitis alone accounted for one-fourth of these injections. Judging from Period I rates, bronchitis, pneumonia, influenza, strep throat, sinusitis, and pharyngitis were relatively commonly treated with lincomycin. By Period II, its use was greatly reduced; only 420 such injections were given (6 per cent of the total), mostly for pharyngitis, bronchitis, and strep throat. The billed-per-visit rate for all lincomycin injections fell from 0.07 in Period I to 0.01 in Period II.

Tetracycline. Approximately 10 per cent of the 17,100 antibiotic injections in Period I were tetracycline; of these, about 63 per cent were given for bronchitis, acute URI, diarrhea, influenza, and pharyngitis (Table 5.6). More than 10 per cent of all visits for influenza, pyelonephritis and diarrhea involved a tetracycline injection. Use of tetracycline almost disappeared by Period II (to 4 per cent of all antibiotic injections). Its use was confined chiefly to pharyngitis and bronchitis, and no more than 1 per cent of the visits for any diagnosis were treated with tetracycline.

Long-Acting Penicillin. During Period I, 4 diagnoses accounted for over 60 per cent of the 1,630 LA penicillin injections—pharyngitis, otitis media, acute URI and strep throat (Table 5.7). Three diagnoses accounted for 69 per cent of the LA penicillin use in Period II—pharyngitis, strep throat and otitis media. This was the only antibiotic category in which the number of injections increased over time (from 9 to 47 per cent of all IM antibiotics). Similarly, the largest increases in the billed-per-visit rates between Periods I and II were for these same 3 diagnoses: strep throat, from 0.12 to 0.43; pharyngitis, 0.06 to 0.15; and otitis media, 0.10 to 0.14.

Summary. Infectious disease and antibiotic injection data from Period I illustrate that a small number of diagnoses accounted for most injections. These common diagnoses were frequently treated with intramuscular antibiotics. Figures 5.1 and 5.2 summarize these data. Figure 5.1 illustrates that 6 diagnoses accounted for more than 50 per cent of all SA penicillin, lincomycin, LA penicillin (bicillin), ampicillin and tetracycline injections, and three diagnoses alone—URI, pharyngitis and bronchitis—for more than 50 per cent of all SA penicillin and lincomycin injections. Figure 5.2 shows that, in Period I, more than 50 per cent of patient visits attributed to strep throat, pharyngitis, bronchitis and influenza included an antibiotic injection and that more than one-third of visits attributed to otitis media and URI involved an IM antibiotic injection.

Penicillin was the drug of choice for 5 diagnoses; patients diagnosed as having bronchitis were as likely to receive lincomycin as penicillin. By Period II, SA and LA penicillin were the only IM antibiotic injections given in more than one-fourth of patient visits attributed to any diagnosis. Lincomycin was almost never given. The diagnoses of acute URI, pharyngitis and bronchitis accounted for almost 50 per cent of the SA penicillin injections but the number of penicillin injections given in Period II was less than one-third the number in Period I.

Changes in Diagnoses Between Periods I and II

To examine the issue of possible deliberate shifts in diagnosis, we looked for changes in selected diseases classified as either "bacterial" (strep throat, otitis media, sinusitis, pharyngitis and pneumonia) or "viral" (influenza, acute URI, cough, bronchitis and laryngitis). We

TABLE 5.5. Number and Per Cent of Ambulatory Visits and Lincomycin Injections, and Injections Billed per Visit, by Diagnosis, Periods I and II

	Ambulatory Visits				Lincomycin Injections					
	Period I		Period II		Period I		Period II		Period I Billed/ Visit	Period II Billed/ Visit
Diagnosis*	Number†	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent		
Bronchitis	5,300	8	5,100	7	1,120	26	60	15	.21	.01
Pharyngitis	6,500	10	7,400	10	920	21	100	25	.14	.01
Acute URI	6,900	11	5,600	8	400	9	30	7	.06	.01
Otitis media	3,000	5	3,100	4	320	7	30	8	.11	.01
Influenza	1,700	3	1,100	2	260	6	20	4	.15	.01
Streptococcal sore throat	1,200	2	1,600	2	180	4	40	10	.15	.03
Pneumonia	900	1	1,100	2	140	3	10	2	.16	.01
Sinusitis	900	1	1,300	2	140	3	10	2	.15	.01
Skin infection	1,400	2	1,400	2	80	2	10	2	.06	<.005
Cystitis	1,900	3	2,400	3	60	2	10	2	.03	<.005
Subtotal	29,700	46	30,100	42	3,620	84	320	77	.12	.01
All others	34,200	54	41,900	58	690	16	100	24	.02	<.005
Total‡	63,900	100	72,000	100	4,310	100	420	100	.07	.01

* Ranked according to number of lincomycin injections in Period I.

† Numbers were rounded for presentation; percentages were calculated on the basis of actual, not rounded, numbers.

‡ All totals do not add because of rounding.

TABLE 5.6. Number and Per Cent of Ambulatory Visits and Tetracycline Injections, and Injections Billed per Visit, by Diagnosis, Periods I and II

	Ambulatory Visits				Tetracycline Injections					
	Period I		Period II		Period I		Period II		Period I Billed/ Visit	Period II Billed/ Visit
Diagnosis*	Number†	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent		
Bronchitis	5,300	8	5,100	7	260	14	50	17	.05	.01
Acute URI	6,900	11	5,600	8	260	14	30	10	.04	.01
Diarrhea	2,400	4	3,500	5	240	14	10	3	.10	<.005
Influenza	1,700	3	1,100	2	200	11	10	3	.12	.01
Pharyngitis	6,500	10	7,400	10	180	10	50	17	.03	.01
Cystitis	1,900	3	2,400	3	150	8	10	3	.08	<.005
Sinusitis	900	1	1,300	2	70	4	10	3	.08	<.005
Otitis media	3,000	5	3,100	4	50	3	10	3	.02	<.005
Pyleonephritis	400	1	600	1	50	3	< 5	1	.11	.01
Skin infection	1,400	2	1,400	2	30	2	—	—	.02	—
Subtotal	30,400	48	31,500	44	1,490	83	180	60	.05	.01
All others	33,500	52	40,500	56	300	17	110	40	.01	<.005
Total‡	63,900	100	72,000	100	1,790	100	290	100	.03	<.005

* Ranked according to number of tetracycline injections in Period I.

† Numbers were rounded for presentation; percentages were calculated on the basis of actual, not rounded, numbers.

‡ Totals may not add because of rounding.

TABLE 5.7. Number and Per Cent of Ambulatory Visits and Long-Acting Penicillin Injections, and Injections Billed per Visit, by Diagnosis, Periods I and II

	Ambulatory Visits				Long-Acting Penicillin Injections					
	Period I		Period II		Period I		Period II		Period I Billed/ Visit	Period II Billed/ Visit
Diagnosis*	Number†	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent		
Pharyngitis	6,500	10	7,400	10	370	23	1,140	35	.06	.15
Otitis media	3,000	5	3,100	4	310	19	420	13	.10	.14
Acute URI	6,900	11	5,600	8	190	12	90	3	.03	.02
Streptococcal sore throat	1,200	2	1,600	2	140	8	690	21	.12	.43
Bronchitis	5,300	8	5,100	7	100	6	230	7	.02	.04
Skin infection	1,400	2	1,400	2	60	4	90	3	.04	.06
Influenza	1,700	3	1,100	2	60	4	30	1	.03	.03
Pneumonia	900	1	1,100	2	50	3	80	2	.05	.08
Diarrhea	2,400	4	3,500	5	20	2	40	1	.01	.01
Sinusitis	900	1	1,300	2	20	1	160	5	.02	.13
Subtotal	30,200	47	31,200	44	1,320	82	2,970	91	.04	.10
All others	33,700	53	40,800	57	310	19	290	9	.01	.01
Total‡	63,900	100	72,000	100	1,630	100	3,260	100	.03	.05

* Ranked according to number of long-acting penicillin injections in Period I.

† Numbers were rounded for presentation; percentages were calculated on the basis of actual, not rounded, numbers.

‡ Totals may not add because of rounding.

hypothesized that if physicians were trying to circumvent EMCRO guidelines, they would (by Period II) alter the ratios of bacterial to viral diagnoses. By labeling more patients with respiratory symptoms as bacterial, they would be able to justify more fully their use of antibiotic injections.

The 5 bacterial diagnoses above made up about 18 per cent of *all* ambulatory visits in both periods, and the 5 viral diagnoses another 21 and 16 per cent in Periods I and II, respectively. Of *all* visits to MD solo providers, 8 per cent in Period I were for these 5 bacterial diagnoses, 7 per cent for the 5 viral diagnoses. The figures were 8 and 7 per cent in Period II as well. Of *all* visits to DO solo providers, 7 per cent were bacterial and 10 per cent viral in Period I, 7 per cent bacterial and 6 per cent viral in Period II. The percentages of visits with either bacterial or viral diagnoses were about the same in Periods I and II for all primary care specialties. The largest differences were for DO general practitioners and surgeons, who labeled fewer visits as having a viral etiology.

These 10 infectious diseases accounted for approximately 25,000 and 23,800 visits in Periods I and II, respectively, of which roughly half were for the 5 bacterial diagnoses (Table 5.8). The distribution of bacterial/viral categories differed by physician type (Table 5.8). Depending on the specific physician category, between 44 and 56 per cent of MD visits could be classified bacterial in Period I and between 48 and 52 per cent in Period II; the range for the various DO categories was 33 to 75 per cent in Period I and 52 to 63 per cent in Period II. A marked increase in the percentage of visits classified as bacterial between Periods I and II was observed for outlier DOs, other noncertified DOs, and noncertified group practices; for other physician types, no such increase was observed.

TABLE 5.8. Distribution of Visits of Bacterial and Viral Origin by Type of Physician, Periods I and II

Type of Physician	Period I			Period II		
	Number of Visits		Per Cent Bacterial	Number of Visits		Per Cent Bacterial
	Total*	Bacterial		Total*	Bacterial	
Outlier MD†	2,500	1,400	56	2,500	1,300	52
Other noncertified MD	4,500	2,000	44	4,200	2,000	48
Certified MD	2,800	1,400	50	2,900	1,500	52
Total MDs	9,800	4,800	49	9,600	4,800	50
Outlier DO†	2,700	900	33	1,600	900	56
Other noncertified DO	6,900	2,700	39	6,700	3,500	52
Certified DO	800	600	75	800	500	63
Total DOs	10,400	4,200	40	9,100	4,900	54
Noncertified groups	500	200	40	1,600	1,000	63
Certified groups	2,800	1,600	57	2,700	1,600	59
Total groups	3,300	1,800	55	4,300	2,600	60
All others‡	1,500	600	40	800	400	50
Total	25,000	11,400	46	23,800	12,700	53

* Total of the 5 bacterial and 5 viral diagnoses listed in text.
† All outliers were noncertified.
‡ For whom certification status was unknown.

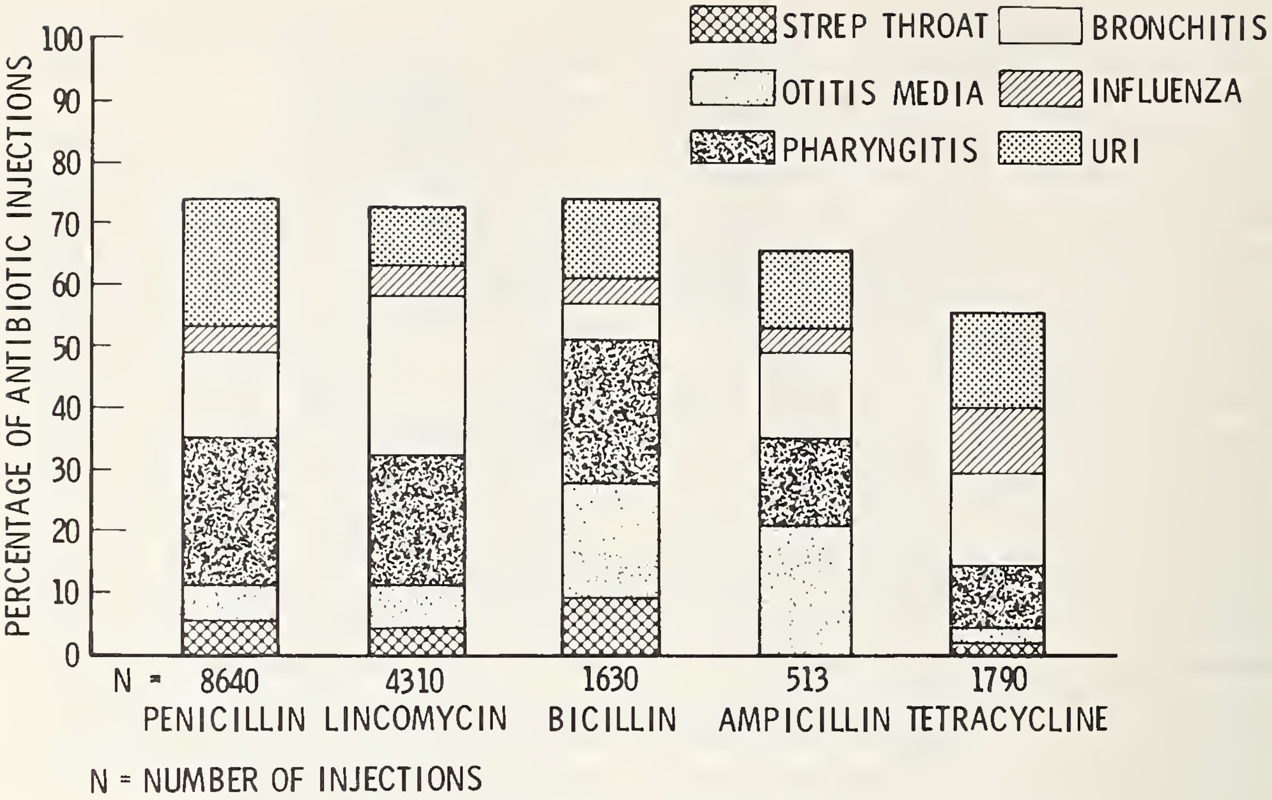

FIG. 5.1. Use of selected antibiotic injections before peer review, by diagnosis.

To explore this phenomenon further, we investigated diagnoses relating strictly to "sore throat." In such cases, presumably 1 of 2 diagnoses would be made: pharyngitis (a nonspecific term for sore throat) and strep throat (a specific term indicating the presence of a streptococcus, most likely beta-hemolytic).

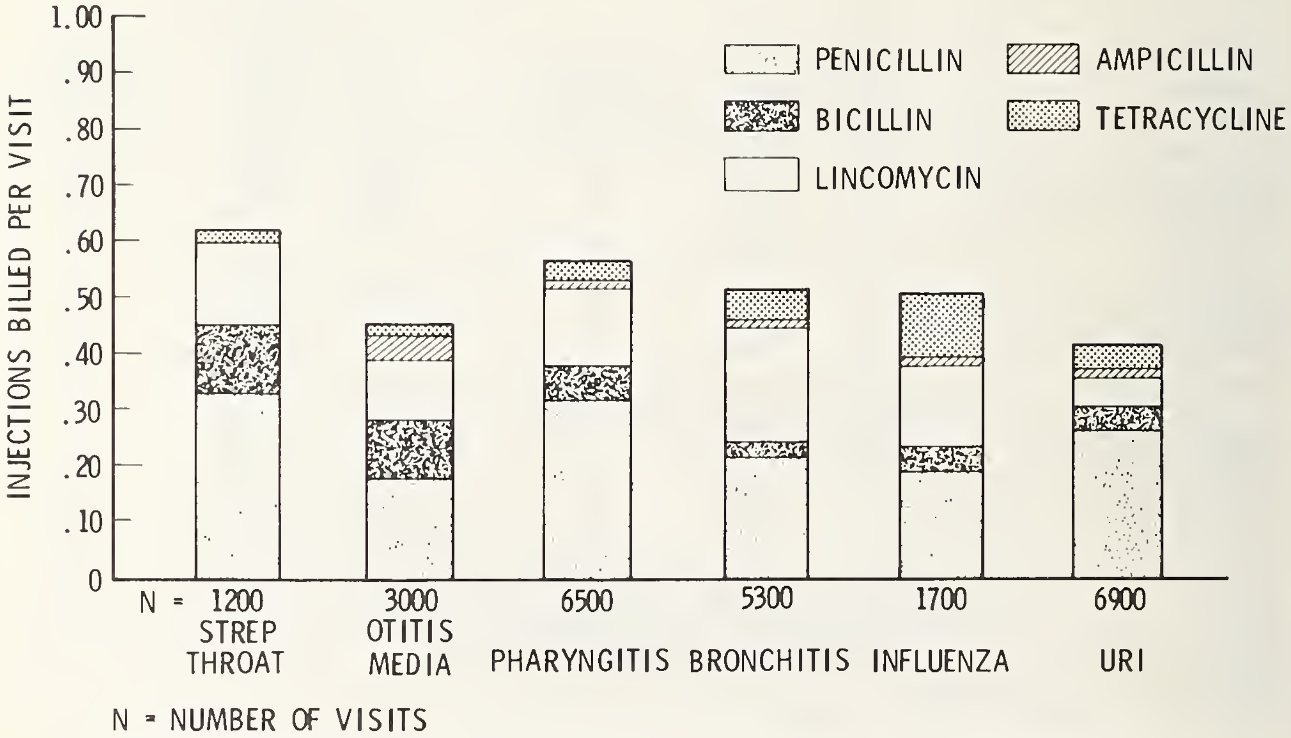

FIG. 5.2. Treatment of selected diagnoses before peer review, by type of injectable antibiotic.

EMCRO guidelines were written to encourage use of LA penicillin if an antibiotic injection were to be given for strep throat and (after careful monitoring) to permit the same therapy for pharyngitis as long as it was not given too often. Under these circumstances, to justify the use of injectable antibiotics, a physician might opt for the specific diagnosis of strep throat for all cases of sore throat in which that diagnosis was even remotely possible.

This reasoning would be reflected in an increase in the percentages of cases of strep throat between the 2 periods. Although visits for strep throat increased slightly as a percentage of all "sore throat" visits (Table 5.9) and as a percentage of all visits for infectious disease, from any clinical or programmatic point of view, it was not a particularly meaningful shift.

Increases in the percentage of "sore throat" cases labeled strep throat were observed especially for noncertified groups, outlier DOs, and certified DOs (Table 5.9). Decreases were seen for outlier MDs, noncertified DOs, and all other providers. Certified group practices and certified and noncertified MDs were quite consistent over time in their use of the specific diagnosis of strep throat.

Within this "sore throat" class of diagnoses, some differences in the choice of the label "strep throat" or "pharyngitis" were observed among the different physician categories (Table 5.9). As will be seen in results of the episode analyses (Chapter VI), certified group practices relied much more on throat or strep cultures in these diagnoses than did any other provider type. Thus, arguably the "true" rate of strep throat compared with pharyngitis is closer to the one consistently observed for the certified groups, namely about 35 per cent of all visits for "sore throat." Even in Period II, some provider types had percentages for strep throat markedly lower than this (e.g., all solo practice MDs); with the possible exception of DO outliers (41 per cent) or noncertified groups (47 per cent), however, no physician types labeled a markedly higher percentages of visits for sore throat as strep throat. Thus, we could *not* demonstrate that physicians with the highest overuse of injections labeled a higher proportion of their patients with infectious diseases as having a bacterial condition.

In summary, we concluded that the overall shift among these Medicaid providers in terms of moving from "viral" to "bacterial" diagnoses in general or from "pharyngitis" to "strep throat" in particular was minimal and, if done, may have represented a true improvement in the accuracy or precision of diagnostic labeling. Certainly in the population as a whole, little or no clinical or programmatic significance should be attached to the observed change. These shifts do not affect quality of care interpretations of our results in any meaningful way. From the point of view of peer review operations, however, such information might have implications for more stringent review of claims from individual providers or classes of physicians.

Overall Use of IM Antibiotics by Physician Type

Having established that no critical shifts in diagnosis occurred relevant to these analyses, we examined more conclusively whether the EMCRO reduced use of injections in accordance with review guidelines. The hypothesis was that use of antibiotic injections would fall more for respiratory symptoms associated with viral etiologies (in which antibiotics were of presumably no benefit) than for bacterial entities.

In Period I, the billed-per-visit rates for the 5 bacterial and 5 viral conditions listed earlier were 0.46 and 0.29 for all MDs (Table 5.10); respective figures for Period II were 0.26 and 0.09. Thus, by Period II, MDs were giving only 57 per cent as many injections for bacterial infections as in Period I, and 31 per cent as many for viral

TABLE 5.9. Distribution of Visits for Strep Throat and Pharyngitis, by Type of Physician, Periods I and II

	Period I				Period II			
	Number of Sore Throat Visits				Number of Sore Throat Visits			
Type of Physician	Strep Throat	Pharyn-gitis	Total	Per Cent Strep Throat	Strep Throat	Pharyn-gitis	Total	Per Cent Strep Throat
Outlier MD*	140	980	1,120	13	40	910	950	4
Other noncertified MD	90	1,280	1,370	7	100	1,230	1,330	8
Certified MD	60	640	700	9	80	690	770	10
Total MDs	290	2,900	3,190	9	220	2,830	3,050	7
Outlier DO*	140	500	640	22	310	450	760	41
Other noncertified DO	280	1,370	1,650	17	230	1,780	2,010	11
Certified DO	20	330	350	6	60	240	300	20
Total DOs	440	2,200	2,640	17	600	2,470	3,070	20
Noncertified groups	20	80	100	20	330	370	700	47
Certified groups	280	510	790	35	310	520	830	37
Total groups	300	590	890	34	640	890	1,530	42
All others†	90	280	370	24	50	340	390	13
Total	1,120	5,970	7,090	16	1,510	6,530	8,040	19

* All outliers were noncertified.
† For whom certification status was unknown.

infections. DOs behaved similarly. Their use of antibiotic injections for bacterial infections in Period II was 46 per cent of the Period I level and, for viral diseases, 21 per cent.

Outliers among both MDs and DOs used antibiotics in a high percentage of these bacterial and viral illnesses in Period I (Table 5.10): DO outliers in about 90 per cent of these visits and MD outliers in 82 per cent of bacterial and 63 per cent of viral visits. By Period II, MD outliers cut antibiotic use drastically in viral illnesses and halved their use in bacterial cases; DO outliers halved their use in viral diseases and decreased use only a little in bacterial cases.

In Period I, all primary care specialists among the MDs used antibiotics for both bacterial and viral illnesses less than did the respective DO specialties; the one exception (internal medicine) was an artifact of the small number of visits seen by DO internists. MD specialists typically treated viral illnesses far less frequently with antibiotics than bacterial illness. The various specialty categories of DOs, however, used antibiotic injections with similar frequency for both categories of diagnoses. By Period II, DO and MD specialties had reduced the use of antibiotic injections for both types of illnesses. Comparisons by specialty could be made only cautiously because some specialty classes had few patient visits in Period II; among general practitioners, however, the use of antibiotics by MDs and DOs was similar (about 31 and 9 per cent of visits for bacterial and viral diagnoses, respectively).

Use of Specific IM Antibiotics by Provider Type and Diagnoses

The final set of analyses in this phase of the study focused on the use of specific types of antibiotic injections for selected patients by type of provider. This allowed us to examine whether different specialists or provider types used antibiotics more or less appropriately and whether they used antibiotics interchangeably (regardless of diagnosis). Only major findings, generally those that highlight differences among providers, are reported here.

Outlier MDs. MD outliers used antibiotic injections in 62 per cent of their visits in Period I. The 15 most common infectious diagnoses among these physicians had billed-per-visit rates greater than 0.50, suggesting that injections were given for many infections that probably were viral in origin. Diagnoses frequently given antibiotics (generally SA penicillin) included pharyngitis (0.82),† sinusitis (0.81), influenza (0.77), fever of unknown origin (0.73), bronchitis (0.68), and pyelonephritis (0.59). By Period II, the percentage of visits with antibiotic injections dropped markedly (to 34 per cent). In addition, the type of antibiotics used changed radically; only 12 per cent of the visits involved an SA penicillin injection (compared with 48 per cent in Period I) and LA penicillin became the drug of choice. Lincomycin was almost never used as an injectable antibiotic by these physicians.

Other Noncertified MDs (Outliers Excluded). In Period I, overall use of antibiotic injections by this category of physicians was similar to that of certified MDs except for higher billed-per-visit rates for gonorrhea (0.84), fever of unknown origin (0.28), hypertrophy of the tonsils and laryngitis (both 0.25), and bronchitis (0.24). By Period II, the number of SA penicillin injections and the billed-per visit rate for all infectious diagnoses decreased markedly. Higher use of LA penicillin was observed for pharygitis (0.18) and strep throat (0.42)

Certified MDs. These providers seldom used injectable antibiotics in either Period I or Period II (billed-per-visit rates of 0.15 and 0.09, respectively). The 4 diagnoses treated most frequently with injectable antibiotics were: strep throat (0.45), pneumonia (0.48), pharyngitis (0.26), and gonorrhea (0.23). Use of antibiotics declined for all diagnostic categories except gonorrhea (0.36) and strep throat (0.43). The majority of patients with strep throat were treated with either SA or LA penicillin in both time frames, with the latter favored slightly in Period II.

DO Outliers. As with MD outliers, DO outliers had a high rate of use of injectable antibiotics—85 per cent of all visits in Period I. The URI complex of diagnoses was primarily responsible for this high rate, but even diagnoses such as conjunctivitis and diarrhea received antibiotic injections fairly often (0.43 and 0.58, respectively). DO outliers preferred lincomycin for treatment of many diagnoses, with SA penicillin as second drug of choice. Of their Period I injections, more than 50 per cent were lincomycin and 40 per cent were SA penicillin.

During Period II this group still had the highest rate of injections billed per visit (0.50) among the different provider categories. Rates greater than 0.50 were found for hypertrophy of the tonsils, acute URI, influenza, laryngitis, sinusitis, otitis media, and bronchitis. Use of injectable lincomycin was nearly eliminated; the vast majority of strep throat and pharyngitis cases were treated with LA penicillin.

Other Noncertified DOs (Outliers Excluded). Noncertified DOs had a moderately high rate of IM antibiotic use per visit (0.55) in Period I. Twenty-five per cent of all visits included SA penicillin injections, 18 per cent lincomycin. Injectable antibiotics (chiefly SA penicillin, occasionally lincomycin) were often used to treat the following: pharyngitis, pneumonia, fever of unknown origin, and influenza (all 0.68), otitis media (0.61), hypertrophy of the tonsils and cough (both 0.56). Use of injectable antibiotics declined to 12 per cent of visits in Period II. Lincomycin was completely eliminated,

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† Billed-per-visit rates in parentheses in this section.

TABLE 5.10. Antibiotic Injections Billed per Ambulatory Visit for Selected Bacterial and Viral Diagnoses, by Provider Type, Certification Status, and Specialty, Periods I and II

	Period I Antibiotic Injection Rate per Visit		Period II Antibiotic Injection Rate per Visit	
Type of Provider	Bacterial Diagnoses*	Viral Diagnoses*	Bacterial Diagnoses	Viral Diagnoses
Outlier MDs†	.82	.63	.42	.17
Other noncertified MDs	.30	.19	.18	.06
Certified MDs	.25	.14	.17	.05
Total MDs‡	.46	.29	.26	.09
Outlier DO†	.91	.90	.73	.46
Other noncertified DO	.67	.60	.25	.08
Certified DO	.78	.30	.16	.03
Total DOs‡	.72	.67	.33	.14
Noncertified groups	.15	.10	.39	.02
Certified groups	.32	.15	.18	.03
Total groups‡	.28	.12	.28	.08
MDs in				
Internal medicine	.36	.20	.25	.06
Pediatrics	.20	.07	.17	.04
General practice	.57	.34	.31	.09
Obstetrics/gynecology	.00	.15	.00	.00
Surgery	.32	.33	.10	.10
DOs in				
Internal medicine	.20	.00	.00	.00
Pediatrics	.70	.60	.10	.00
General practice	.74	.63	.31	.08
Obstetrics/gynecology	.78	.79	.49	.54
Surgery	.66	.74	.26	.06

* Five bacterial and 5 viral diagnoses listed in text.
† All outliers were noncertified.
‡ Includes physicians with unknown certification status.

SA penicillin was occasionally used to treat the URI complex of diagnoses and reliance upon LA penicillin for strep throat and pharyngitis increased.

Certified DOs. These physicians used injectable antibiotics (mostly SA and LA penicillin and tetracycline) in 53 per cent of their visits during Period I. Compared with other physician types, certified DOs relied heavily on tetracycline for treatment of pelvic inflammatory disease (0.83), pharyngitis (0.80), and pyelonephritis and cystitis (0.44). Use of IM antibiotics decreased to 8 per cent of visits in Period II. LA penicillin accounted for the majority of these injections (e.g., 72 per cent of strep throat visits).

Group Practices—Certified and Noncertified. Group practices seldom used injectable antibiotics. The billed-per-visit rate was nearly the same in Periods I and II (0.07 and 0.06). Groups consistently used LA penicillin to treat both strep throat and pharyngitis, more so in Period II than I.

Treatment of "Sore Throat": A Summary Example

To summarize the information reported above, we investigated what happened to patients who came to their physicians with "a sore throat" (i.e., pharyngitis or strep throat). Table 5.11 gives the billed-per-visit rates for all antibiotic injections together and specific antibiotic injections for the combined "sore throat" diagnosis. Use of antibiotics, not surprisingly, dropped for virtually all categories of physicians. The one exception was noncertified group practices; one explanation for their increase may be the marked rise in "strep throat" diagnoses observed for this category of provider.

Lincomycin use decreased most (largely among the DOs who had the highest rates of use initially). LA penicillin use, as would be expected, increased quite dramatically among certain providers, such as outlier DOs. The differences by specialty (e.g., the differential use of LA penicillin by MD gynecologists versus other specialists) must be interpreted with caution because of the small number of cases involved; the large majority of these patients (among solo providers) were seen by general practitioners.

Discussion

Although some change was noted in the way certain physician categories recorded diagnoses on claim forms (in terms of favoring strep throat in situations of "sore throat"), no major shifts in diagnoses were observed. The peer review process thus did not prompt any wholesale effort to circumvent EMCRO injection guidelines nor introduce any perverse incentives for submitting claims or recording diagnoses.

Some physicians apparently had underlying preferences or biases for antibiotics for all respiratory tract diagnoses; that is, they evidently did not carefully tailor their choice of antibiotic injection to specific diagnoses or patient age groups. This has important implications for medical education and training, suggesting that greater emphasis on selecting organism- and patient-specific antibiotics is needed in basic pharmacologic or clinical training.

The Period I data, which presumably reflected the "usual" state of care in the New Mexico Medicaid program, confirmed many other observations that use of antibiotic injections was associated with deficiencies in the quality of care. These deficiencies were not distributed evenly across physician types. For instance, among DOs, two-thirds of all patients having common viral illnesses were treated with injectable antibiotics; among outlier DOs, lincomycin was the drug of choice. By contrast, group practices composed of board-certified physicians used antibiotic injections much more sparingly in bacterial and especially viral illnesses; when they did give antibiotic injections, LA penicillin was the preferred drug.

Five injectable antibiotics and 10 to 12 diagnoses accounted for most antibiotic injection use and the reasons for which they were used. Injections are by no means the only relevant service to investigate or monitor by a peer review system, and obviously other acute and chronic illnesses must be considered. Nonetheless, these categories could be considered as the core of a successful system for monitoring ambulatory care in other Medicaid programs.

These findings also support the use of focusing on the basis of physician type or physician profile; indeed, this was subsequently done by the New Mexico PSRO (as discussed in Chapter II). As already noted, marked differences were observed in appropriate use of antibiotics for selected diagnoses by board certification status and especially outlier status. Little evidence emerged as to whether different types of specialists (primary care specialists such as internists or pediatri-

TABLE 5.11. Injections Billed per Ambulatory Visit for "Sore Throat"* by Provider Types, Certification Status and Specialty, All Antibiotics, and 4 Antibiotic Classes, Periods I and II

Provider Type and Certification Status	All Antibiotics		Long-Acting Penicillin		Short-Acting Penicillin		Lincomycin		Tetracycline	
	Period I	Period II	Period I	Period II	Period I	Period II	Period I	Period II	Period I	Period II
Outlier MDs	.81	.44	.04	.28	.54	.14	.22	.02	.01	<.005
Other noncertified MDs	.32	.19	.06	.09	.21	.08	<.005	.01	.02	<.005
Certified MDs	.27	.20	.04	.09	.21	.09	.01	<.005	<.005	<.005
Total MDs†	.50	.28	.05	.16	.34	.10	.08	.01	.01	<.005
Outlier DOs	.95	.77	<.005	.54	.39	.15	.54	.04	.01	.03
Other noncertified DOs	.70	.26	.01	.14	.40	.10	.24	.02	.04	<.005
Certified DOs	.79	.21	.01	.18	.54	<.005	.06	.03	.19	0
Total DOs†	.77	.38	.01	.24	.40	.10	.29	.02	.05	.01
Noncertified groups	.27	.50	.06	.34	.20	.10	.01	.03	<.005	0
Certified groups	.32	.20	.19	.19	.12	.01	0	0	0	<.005
Total groups†	.29	.34	.15	.22	.12	.08	<.005	.01	<.005	.01
MDs in										
Internal medicine	.47	.38	.11	.18	.29	.17	.07	.03	0	0
Pediatrics	.16	.17	.09	.11	.06	.04	0	<.005	0	0
General practice	.60	.31	.03	.19	.42	.10	.11	.01	.02	<.005
Obstetrics/gynecology	.30	0	.25	0	.10	0	0	0	0	0
Surgery	.33	.13	.04	.02	.25	.11	.03	0	0	<.005
DOs in										
Internal medicine	.37	0	0	0	0	0	.37	0	0	0
Pediatrics	.64	.14	.03	.07	0	0	.61	.01	0	0
General practice	.80	.34	<.005	.23	.42	.10	.30	.01	.06	<.005
Obstetrics/gynecology	.75	.49	.01	.32	.63	.08	.05	.05	.07	.03
Surgery	.70	.48	.01	.17	.29	.27	.37	.02	.04	<.005

* Streptococcal sore throat and pharyngitis.

† Includes providers with unknown certification status.

cians compared with gynecologists or surgeons, or with general practitioners) systematically use more or less appropriate antibiotic injections for the common respiratory diagnoses studied. This was largely because most care for these diagnoses was given by general practitioners (few, if any, being newly trained "family practitioners"); hence, sample sizes for other physician types were sometimes quite small. To the degree that outliers were mainly in general practice, the inference could be drawn that internists and pediatricians did give, on average, better care. Nonetheless, further analysis by all these professional characteristics is warranted.

These findings corroborated the conclusions stated in Chapter III that the New Mexico EMCRO had a major effect on the quality of medical care, by eliminating inappropriate injections given mainly for problems of a viral nature, for which antibiotics are unlikely to be justified. It brought about this decline in 2 years, without prompting any systematic effort on the part of physicians to choose selectively diagnoses that would justify continued use of injections. The peer review system apparently developed rational guidelines acceptable to physicians, appropriately disseminated information about those guidelines, and successfully enforced them. As stated in Chapter III, the peer review efforts improved the average level of quality in this Medicaid program and reduced its variance, by bringing the performance of outlier physicians more in line with that of the physician types giving considerably better care throughout the entire study.

One implication of these findings regarding injections alone is the possible role of similar national guidelines for use of injectable drugs, promulgated perhaps by some national body such as the PSRO National Council. Such guidelines could be aimed at "minimal" criteria for appropriate use of drugs, perhaps related to a relatively select group of diagnoses that account for much of the ambulatory care in the country today. They might specify, for example, the types of injections that are explicitly disapproved for specified diagnoses or age groups or both (e.g., tetracycline for young children), and how frequently an antibiotic should be given for identified types of patients with given diagnoses (e.g., for strep infections, injectable SA penicillin must be either repeated or followed with oral penicillin of the same type). Information on which to base such guidelines must come from "epidemiologic" data derived from studies such as this one, from special studies of the distribution of antibiotics used, from evidence in the literature regarding the efficacy of antibiotic injections for specific conditions, and from clinical trials.

At the end of this phase of the study, certain questions remained that needed to be addressed by investigating more comprehensive episodes of these same illnesses. The principal issues (apart from methodologic ones) were whether the peculiarities of injectable antibiotics in Period I were reflected in oral antibiotic use in either Period I or II, whether the shift in use of IM antibiotics was accompanied by undesirable changes in the use of oral drugs, and whether laboratory tests were used appropriately as an adjunct to making the correct diagnoses. These are some of the questions considered in the next chapter.

VI. Quality of Care for Episodes of Common Respiratory Illnesses

THE ANALYSES and discussions in the previous chapters make clear that a number of topics have not yet been fully addressed, especially those involving how entire episodes of illness were cared for in the Medicaid population during the period in which the EMCRO was operating. For example, did the inappropriate use of injections in the early months of the EMCRO review program reflect inappropriate care along other dimensions as well, such as use of office visits, diagnostic tests, or prescription drugs? As the use of inappropriate injections declined, did a quality-of-care-related response occur in other facets of primary care, such as increases in laboratory tests to confirm diagnoses, or substitution of medically correct (or incorrect) prescription drugs for injectable drugs? This chapter reports the findings of analyses on episodes of illness designed to examine these questions.

In particular, the objectives of this phase of the study were as follows:

> To determine if episodes of care could be used as a unit of analysis in evaluating quality of care.
>
> To investigate the care provided for episodes of common ambulatory illnesses in a Medicaid population using a restricted set of process criteria involving antibiotic medications and common laboratory tests to assess quality.
>
> To determine if quality of care in such episodes differed by "structural" physician characteristics.
>
> To determine whether physicians who apparently gave poor quality of care as measured by a single criterion (use of injectable drugs) gave consistently poor care when measured by more than one criterion.
>
> To evaluate what effect (if any) peer review had on the quality of ambulatory care over time.

Using Episodes of Illness in Ambulatory Care Review

As the interest in quality of ambulatory care has grown, so has recognition that such review preferably should be based on more than just individual services or encounters. Such review should draw on entire illness episodes because description and assessment of the elements of care one at a time misses the design, the rationale, and the implications of the strategy as a whole, including the consequences of taking or not taking certain actions.[16]

Efforts to use episodes in quality of care work are needed for several reasons. Focusing on entire episodes permits a better evaluation of the patient's true state of health and allows for analysis in terms of progression, remission, and resolution of illness over time. It permits investigation of the possible substitution among services and provides an opportunity to look at the timeliness of services. It can control for the probable availability or nonavailability of diagnostic data (e.g., laboratory work) in evaluating other aspects of medical management (e.g., drugs, follow-up physician visits).

Despite the theoretic advantages of episode analysis, it is a poorly developed method, and the literature in this area is sparse for both methods and analytic findings. The earliest explicit statement and discussion of the rationale for using episodes of care described episode analysis as "clustering discrete units of service into cohesive entities" based on the patient's medical problem, time interval between services, and nature of medical management.[79] Although this work was conceptually forward-thinking, it was given only little practical application,[80] and none relating to the use of insurance claim forms.

Lasdon and Sigmann[49] investigated the feasibility of using episodes of care in a cost-effectiveness study. Although neither the data source nor the routines for creating episodes were computer-based, their results suggested that episodes of a chronic disease (hypertension) could be created from an audit of patient records and could be used to evaluate health care in different types of practice settings.

Moscovice[58] developed a set of problem-specific computer-based algorithms for defining episodes of care as part of an evaluation of the Frontier Nursing Service in Kentucky. He defined "patterns of care" for otitis media, pharyngitis/tonsillitis and urinary tract infection, and studied variations in the prevalence of those patterns by provider team characteristics (Frontier nurse, registered nurse, physician, and various combinations thereof) and location (district office versus central hospital). His work is among the first practical applications of episode analysis for use in quality assessment. His methods are not entirely transferable to quality-of-care review using insurance claim forms, however, because his data source was an "encounter form" developed specifically for the Frontier Nursing Service. These forms provided "treatment history" codes indicating actions such as acute follow-up or routine care for a chronic problem, data elements that normally are unavailable on insurance claims. When reliable treatment history data are not available, creating episodes of illness is substantially more difficult. Moreover, Moscovice did not attempt to make quality-of-care appraisals per se but rather described patterns of patient care processes and variations as a function of provider characteristics.

Roos and her colleagues[69, 71, 72] have used computer-based claim files from provincial insurance records in Saskatchewan and Manitoba to create episodes of illness involving inpatient diagnoses such as tonsillectomy and adenoidectomy. Their work clearly supports the feasibility of using episodes to describe the use of medical services and quality of care, but, strictly speaking, it is not directed at evaluation of the processes of ambulatory care.

Kane and his colleagues[37–40] carried out a series of studies on processes, outcomes and costs of episodes of care in model family practice clinics in Utah. One study compared outcomes and costs of care by levels of providers (faculty, residents, physician assistants). Their data sources were clinic and hospital medical and billing records, as well as supplemental information collected by interviewers on the patients' demographics, functional status and satisfaction with care. The episodes studied, which covered a wide variety of acute ambulatory conditions, were assumed to begin at the first patient visit to the clinic. The physician at this first visit was asked to estimate the time at which the patient would be restored to the level of functional status enjoyed prior to the present illness. All services between the visit that began the episode and the follow-up interview performed by the research team at the time specified by the physician were included in the episode. Their findings include the following: a positive relationship between process and outcome measures; little or no difference in quality by level of provider; and lower average cost of an episode of care for patients with good outcomes than for those with bad outcomes.

Some methodologic questions can be raised about this work, such as the possibility of services in an episode having been given outside the clinic system or before the initial visit, the justification of including all services in an episode regardless of diagnosis, and the small sample size available for diagnosis-specific analyses. It is, however, one of the first efforts reported that attempted both to assess the costs and quality of care in entire illness episodes and to evaluate the care given by different types of providers; hence, it provides a useful step forward in quality-of-care research and corroborative evidence that episodes are feasible analytic units that can be used in such work.

Gold[23] studied the "intensity" of care provided for episodes of common outpatient conditions or complaints (e.g., upper respiratory tract infection, hypertension, chest pain) as a function of location (hospital-based versus freestanding primary care clinics within a Kaiser-Permanente system). Episodes were defined to begin with the first visit for the given study condition and to include related "morbidity contacts" (clinical, laboratory and radiology, but not pharmaceutical) provided only by or through the actions of Kaiser internists. (Morbidity contact was defined as a single diagnosis treated in a single care contact within the Kaiser system.) Little difference in "intensity" of care was observed between the two locations. Differences in quality of care were not observed as a function of level of intensity of care.

Methods

Study Population

To address the 5 objectives listed above, we evaluated the quality of care given to New Mexico Medicaid eligibles who had been enrolled in the Aid to Families with Dependent Children (AFDC) aid category continuously between September 1971 and August 1975. The AFDC cohort was chosen for analysis for several reasons: 1) AFDC eligibles were likely to be relatively healthy (in contrast to the other aid categories for which eligibility criteria were either the presence of a specific chronic condition or handicap, or old age); 2) altogether, AFDC made up the largest portion (about 70 per cent) of Medicaid enrollees in New Mexico; 3) the AFDC *cohort* made up about 25 per cent of Medicaid eligibles and accounted for more than 40 per cent of all Medicaid dollars per eligible per year[8]; and 4) no AFDC eligible had any "crossover" between Medicaid and Medicare (i.e., no services were covered first by Medicare, as is true for Old Age Assistance), meaning that all data on ambulatory care were contained in the data base.

Conditions Studied

We selected 6 conditions for study (HICDA-I codes given in parentheses): streptococcal sore throat (strep throat) (34.0), pharyngitis/tonsillitis (462.0–.9, 463.0–.9), otitis media (381.0–.9), bronchitis (489.0–491.9), influenza (470.0–.9) and acute upper respiratory infection (acute URI) (460.0–.9, 465.0–.9). They were selected for several reasons. 1) They are widely prevalent conditions[57] and are thus of importance for populations other than Medicaid. 2) They accounted for about 33 per cent of all ambulatory care delivered to this cohort over the study period, as they do for a similarly large amount of primary care in the country as a whole. 3) The number of episodes of these diseases were sufficient to permit analyses disaggregated by physician characteristics. 4) Relatively simple process criteria for minimal levels of quality of care (along the deliberately narrow dimensions of appropriateness of medications and laboratory tests) could be established. This made quality-of-care analyses simpler and easier to interpret, while still being powerful enough to detect major deficiencies in care. A peer review organization might wish to address these major deficiencies first before looking for more subtle problems. 5) They were shown in earlier work[7] to have been associated with markedly different patterns of injection use by provider type.

Variables

Patient-specific episodes of care were created that encompassed all ambulatory care given for these conditions in two 6-month periods two years apart. (As noted in Chapter I, Period I in these analyses was September 1971–February 1972; Period II the same months two years later.)

Differences in quality of care according to characteristics of the physician seen in the visit that began an episode were investigated. The structural characteristics were as before: type of practice (group/solo), type of physician training (medical/osteopathic), board certification status, primary care specialty, and outlier status.

Simple disease-specific quality-of-care criteria for appropriate use of antibiotic medications in both injectable and oral form were developed by reference to current medical and pharmaceutical literature[32,53,59,88,90] and up-to-date texts and handbooks on the appropriate use of antibiotics,[17,22,43,47,52,63] by reference to existing quality-of-care criteria sets, and by obtaining the consensus of several board-certified physicians in internal medicine and pediatrics.

The X entries in Table 6.1 specify appropriate antibiotics (or no antibiotics) for the diagnoses listed; entries labeled X were considered to represent at least minimally acceptable levels of care. "No antibiotics" was considered acceptable in circumstances when there were good reasons to believe 1) that a diagnosis usually caused by a bacterium (e.g., strep throat) was being used as a "rule out" diagnosis, as indicated by a high level of use of an appropriate diagnostic test (such as a throat culture in strep throat), or 2) that the diagnosis was caused by a virus that would not respond to an antibiotic and thus should not be treated with one.

Certain diagnostic tests were also specified as elements of good quality care for these diagnoses—for instance, throat or strep cultures for episodes of pharyngitis or strep throat. In addition, at least 1 revisit within 6 weeks was specified as an element of good quality for episodes of otitis media.

Data Sources

A special data tape produced by The Dikewood Corporation (the EMCRO's fiscal intermediary) contained information coded from Medicaid claim forms on ambulatory care provided to AFDC eligibles enrolled continuously from September 1971 to August 1975. It covered the two 6-month periods defined above and was organized chronologically by date of service (not date of payment) for each Medicaid eligible.

Altogether, the tape contained about 330,450 records for the 2 periods, of which 59,570 were ambulatory visits without injections, 2,950 were injections without visits, 18,350 were visits with injections, 225,075 were prescription drugs and 24,330 were laboratory tests. These data represented care for approximately 21,550 persons, mostly women and children, as is characteristic of an AFDC population.

The ambulatory care data tape contained the following items:

1. Ambulatory visits.
2. Injections, grouped according to 38 separate pharmacologic groups. A code indicating whether the EMCRO denied payment for medical reasons was given for each injection in a record. (Up to 3 injections per ambulatory visit were listed in each record.)
3. All prescription drugs, which were coded by the National Drug Code with information about manufacturer, dosage, type of drug and by a special therapeutic code developed by Dr. Richard Atkinson of the New Mexico Department of Health and Social Services for the EMCRO. This therapeutic code had about 150 different categories such as specific type of antibiotic, cold and cough preparations, tranquilizers, antidepressants, and so forth.
4. Laboratory tests and ambulatory diagnostic procedures selected by the research team for their relevance for the study diagnoses; these excluded services that were very unlikely to be associated

TABLE 6.1. Criteria for Minimally Acceptable Antibiotic Use, by Type of Antibiotic and Diagnosis (X indicates acceptable use)

Appropriate Antibiotic Medication	Pharyngitis	Strep Throat	Otitis Media		Bronchitis	Acute URI	Influenza
			Ages 0–4	Ages 5–7			
No injectable or oral antibiotic	X	X*	X†	X†	X	X	X
Oral antibiotics only							
Penicillin	X	X		X	X		
Ampicillin‡			X	X	X		
Erythromycin	X	X	X§	X	X		
Tetracycline‖					X		
Cephalosporin					X		
Injectable and oral penicillin	X	X		X	X		
Injectable and oral ampicillin			X	X	X		
Injectable bicillin¶	X	X		X			
Injectable bicillin and oral sulfa			X	X			
Injectable bicillin and oral ampicillin			X	X			

* Only in instances when the rate of throat culture use by the particular physician is sufficiently high (≥ 30 per cent of all episodes) that we could reasonably believe 1) that the diagnosis was used as a rule-out and therefore 2) that the probability was relatively high that the final diagnosis was not strep throat, based on the results of a culture.

† Only in cases of chronic (serous) otitis media, which is not infectious. We had no way to evaluate whether otitis media was infectious or not from these claims data; thus, this therapeutic option was permitted for all episodes.

‡ Amoxicillin, a new antibiotic not used by the physicians in this study, is at least equivalent to if not better than ampicillin.

§ Erythromycin plus sulfa would also be appropriate.

‖ Ages 8 and older only.

¶ Here and elsewhere, bicillin refers to the LA penicillin used by the providers studied.

with common infectious diseases, such as roentgenography of extremities.

5. Patient information (age, sex, race, aid category, county of residence).

6. Diagnosis: up to 2 diagnoses were available for each service except prescription drugs. These were coded according to HICDA-I codes.

7. Provider linking number that specified the solo physician or group practice who gave the particular service. This allowed a link to be made to information on another tape about the structural characteristics of the 358 providers (313 in solo practice) who had given 100 or more ambulatory visits to Medicaid enrollees in the first 2 years of EMCRO operations. These active providers delivered more than 80 per cent of the ambulatory care to the Medicaid population during those 2 years. Data available on physicians in solo practice included age (date of birth), specialty in which they claimed to practice, county in which they practiced, country of medical education (United States, Canada, or specific foreign country) and board certification status. Data on group practices included specialty, whether the practice was single-specialty or multispecialty, county in which the practice was located, size of the practice and board certification status of the members. Complete data were available for about 95 per cent of these providers; most missing data concerned certification status, especially for physicians in group practice.

We aggregated laboratory tests and prescription drugs into categories meaningful for these specific diagnoses. Thus, analyses focused on 16 categories of oral antibiotics and 12 categories of injectable antibiotics (Table 6.2), where the combinations were chosen empirically because of frequency of use in Period I. (In judging quality of care, "no antibiotic injection" and "no oral antibiotic" were included as possible therapies.)

Creation of Disease-Specific Episodes

The methodologic issues considered in developing disease-specific episodes of care included specifying an optimal length of time for the episode and articulating explicit rules to assign services to episodes when they belonged and to exclude services when they did not belong but occurred within the specified time frame. For these respiratory conditions, episodes were considered on clinical grounds to last possibly longer than 1 week but typically not longer than 4 weeks. Between these extremes, an empirical approach (described below) was used to select an appropriate length of time; 2 weeks was the period finally chosen. (The only exception to this was in revisits for people with otitis media, for which 6 weeks was used.)

To assign each physician visit, laboratory test or injection to 1 and only 1 of the 2 diagnoses that could appear on a claim form, a set of ranking rules was established that specified a hierarchy from diagnoses with a clearly bacterial origin (e.g., strep throat) to those that were more likely viral in etiology (e.g., acute URI) (see Table 5.1). The higher ranking of any 2 diagnoses on a claim form was considered the one most likely to be appropriately treated with an antibiotic or the one most likely to require a specific laboratory test; hence, the higher-ranking diagnosis was used whenever a service could be assigned to more than 1 diagnosis. This had the effect—which was intended—of giving the physician the benefit of the doubt in justifying, for instance, the use of antibiotics.

For each patient, an episode was considered to have begun with a visit for the specific diagnosis and to continue for 2, 3 or 4 weeks thereafter. For each diagnosis-specific episode, all visits, laboratory tests, injections and prescription drugs occurring in the relevant time frames were examined to determine whether the service was given for the specific diagnosis under study, for a different but related infectious disease diagnosis (for example, the remaining 5 of the 6 being studied, sinusitis, pneumonia, etc.) or all other diagnoses (see Appendix A, Tables 1–5). For example, using the 2-week time frame and assuming that a visit for acute URI began an episode of acute URI, services that occurred within the ensuing 2 weeks were counted separately according to whether they were for URI, another infectious disease or any other illness.

TABLE 6.2. Combinations of Injectable and Oral Antibiotics Used in Episode Analyses*

Injectable Antibiotics	Oral Antibiotics
No antibiotic injection	No antibiotic prescription
Penicillin	Ampicillin
Lincomycin	Cephalosporin
Ampicillin	Erythromycin
Tetracycline	Tetracycline
Bicillin	Penicillin
Lincomycin plus penicillin†	Lincomycin
Penicillin plus tetracycline	Sulfa
Lincomycin plus tetracycline	Ampicillin plus tetracycline‡
Bicillin plus penicillin	Ampicillin plus penicillin
Bicillin plus lincomycin	Penicillin plus tetracycline
Ampicillin plus penicillin	Tetracycline plus sulfa
	Penicillin plus sulfa
	Erythromycin plus penicillin
	Erythromycin plus tetracycline
	Erythromycin plus sulfa

* A combination is 1 entry from the first column plus 1 entry from the second column, yielding 192 (12 × 16) unique combinations.

† Means that both a lincomycin and penicillin injection were given in the episode.

‡ Means that both an ampicillin and tetracycline prescription were filled in the episode.

TABLE 6.3. Characteristics of Diagnosis-Specific Episodes by Diagnosis and Length of Episode, Period I

Diagnosis	Visit Rate* (Weeks)			Laboratory Test Rate (Weeks)			Oral Antibiotics Rate (Weeks)			Injectable Antibiotics Rate (Weeks)		
	2†	3†	4†	2	3	4	2	3	4	2	3	4
Strep throat	1.12	1.15	1.15	0.39	0.39	0.43	0.57	0.60	0.59	0.61	0.63	0.64
Pharyngitis	1.15	1.17	1.19	0.14	0.14	0.14	0.70	0.73	0.76	0.63	0.64	0.66
Otitis media	1.19	1.24	1.26	0.12	0.12	0.13	0.68	0.74	0.76	0.53	0.58	0.58
Bronchitis	1.10	1.14	1.16	0.11	0.11	0.11	0.66	0.69	0.72	0.56	0.59	0.60
Influenza	1.15	1.19	1.19	0.10	0.10	0.11	0.51	0.53	0.54	0.54	0.56	0.58
Acute URI	1.13	1.16	1.19	0.14	0.14	0.14	0.52	0.55	0.58	0.44	0.46	0.48

* Rates are calculated as the number of services for only the specific diagnosis divided by the total number of episodes of that diagnosis. See Appendix A, Tables 1–5 for actual figures.

† Length of episode in weeks.

The decision as to the optimal time period for an episode was made by reference to the following criteria: 1) the percentage of services occurring within the time frame that were related to the specific diagnosis under study (as opposed to any other diagnoses) was as high as possible; 2) the number of revisits or laboratory tests for the specific diagnosis under study missed by making the episode too short were as few as possible; and 3) all other things equal, the number of episodes within the study period should be as high as possible.

Based on these criteria, all of which, of course, cannot be optimized simultaneously, the uniformly preferable period of time for an episode of illness for the respiratory diseases studied was 2 weeks. The highest percentages of all visits, laboratory tests, prescriptions and injections occurring within the specific time frame were assigned to the diagnosis defining the episode when the 2-week specification was used (see Appendix A, Tables 1–5). Increasing the length of the episode increased the likelihood that a second disease process would be encountered.

In addition, even when the episode length was increased from 2 to 4 weeks and it was assumed that all additional services given for the diagnosis defining the episode belonged in it (rather than in a different episode of the same diagnosis), the increase in services was not remarkable and would not have meaningfully affected judgments about levels of quality of care. As examples (Table 6.3), when the episode length was doubled (i.e., from 2 to 4 weeks), the number of visits per episode went from 1.19 to 1.26 for otitis media, the number of laboratory tests per episode of pharyngitis did not change (0.14 per episode), the number of antibiotic prescriptions per episode of acute URI went from 0.51 to 0.58, and the number of antibiotic injections for influenza from 0.54 to 0.58. Finally, as would be expected, the 2-week specification resulted in the identification of a substantially higher number of episodes.

A hypothetical example of the construction of an episode is presented in Table 6.4. For each patient, an episode was considered to begin with a visit for a specific diagnosis and to continue for 2 weeks thereafter. All visits, laboratory tests, injections, and prescription drugs occurring in the relevant time frame were assigned either to the diagnosis under study or to another diagnosis by a specific set of algorithms. So as not to confound the analyses with partial episodes, episodes were constrained to begin at least 2 weeks after the start of Period I or Period II and not to begin within 2 weeks of the end of each period.* A set of rules was developed to handle combinations of both oral and injectable antibiotics (separately and together), which accounted for the use of pairs, triplets, and higher-level combinations of antibiotics. These rules resulted in assigning each episode to 1 and only 1 of the 12 antibiotic injection categories and to 1 and only 1 of 16 oral antibiotic categories and then to 1 of 192 (12 × 16) possible combinations (see Table 6.2). Diagnoses were not specified on prescription claim forms. To assign prescription drugs to a specific diagnosis, the following algorithm was developed: within the time frame of the episode, the prescription was assigned to the diagnosis of the first (initiating) visit if no other visit with a different diagnosis intervened between the first visit and the prescription. The prescription was assigned to the diagnosis of the intervening visit if that diagnosis was different from the initial one.† The analyses reported below are based on episodes containing only those services and medications with the diagnosis under study or another related infectious disease diagnosis‡; services and medications given for "other" diagnoses, even though they occurred within the episode time period, were not assigned to the episodes.

Analyses

Once episodes were created, they were assigned to the physician providing the initial visit and an assessment of the quality of care was made for subsets of physicians distinguished by the structural characteristics noted earlier. The quality-of-care judgment was based on the criteria relating to use of antibiotics given in Table 6.1 and the frequency with which a relevant laboratory test was performed. The following are the major computation and comparisons carried out: 1) the percentage of episodes in both Period I and II that each category of provider treated correctly; 2) a comparison of the percentages of episodes treated correctly by physician type for each period—i.e., a measure of the differences in quality of care as a function of physician characteristics; and 3) a comparison of the percentages of episodes treated correctly in Periods I and II—i.e., a measure of the change over time in quality of care presumably produced by the New Mexico peer review system.

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[*] A 2-week specification for an episode can produce a larger number of episodes than a longer specification, because of the total period of time in which an episode can occur. For example, if a 2-week time span is used, only 2 weeks are lost at the beginning and another 2 weeks at the end of the 6-month period, for a total of one-sixth of the entire period, compared with 4 weeks at each end, or one-third of the entire period if a 4-week time span is used.

[†] This same rule was used in assigning laboratory tests to episodes even though claim forms for laboratory tests often had an associated diagnosis. Using the prescription rule slightly increased the number of laboratory tests assigned to an episode (see Appendix A, Tables 2 and 3). As will be seen later, laboratory tests were not done very often in this Medicaid cohort and the adoption of this rule was in line with our desire to give the physician the benefit of the doubt. Under other circumstances, using a different rule may be preferable.

[‡] For purposes of these analyses concerning respiratory tract infections, a related infectious disease was any of the 6 diseases under study (other than the 1 being studied at the moment) or any other illness of any portion of the respiratory tract as listed in Table 5.1 (such as pneumonia).

TABLE 6.4. Construction of an Episode Using a Maximum Length of 2 Weeks

LT_I	V_I	I_I	V_S	P	V_O	P'		P''
Day −3	Day 1						Day 14	Day 16

Time

V_I: Visit beginning an episode.
V_S: Visit for same diagnosis or another related infectious disease within 2 weeks; assigned to episode and counted as a revisit.
V_O: Visit for noninfectious diagnosis or nonrelated infectious disease within 2 weeks; not assigned to episode and not counted as a revisit.
LT_I: Laboratory test, same diagnosis, preceding initial visit of episode; not assigned to episode.
I_I: Injection with same diagnosis, within 2 weeks; assigned to episode.
P: Prescription within 2 weeks; assigned to episode.
P': Prescription within 2 weeks following a visit for a noninfectious diagnosis; not assigned to episode.
P'': Prescription not within two weeks; not assigned to episode.

Results

The results are presented in the following order.

1. Distribution of the number of diagnosis-specific episodes by provider type.
2. Distribution of the antibiotics used in Periods I and II to treat the diagnosis-specific episodes.
3. Discussion of quality of care provided for each diagnosis as judged by the criteria for antibiotic use that reflect at least minimal care. (In addition, Appendix B, Tables 6A–13B contain the specific types of antibiotics and combinations of antibiotics used by each provider type in approximately 90 per cent of all episodes for each diagnosis.) This assessment of the quality of antibiotic use includes a comparison among provider types as to whether statistically significant differences were observed in the percentage of disease-specific episodes treated appropriately and an examination, within each provider type, of whether the quality of care improved significantly between Periods I and II.
4. Selected additional analyses done on the use of tetracycline in children less than 8 years old, multiple classes of antibiotics, lincomycin, and all antibiotics by primary care specialty.
5. Discussion of the use of selected diagnostic procedures (throat and strep cultures, white blood counts, and chest roentgenography). The focus is on general patterns of use of laboratory tests, differences among provider types within each period, and differences between the 2 periods for each provider type.

In the quality-related analyses, tabular information is in the form of the percentages of diagnosis- and provider-specific episodes that were associated with a specified pattern of medication or laboratory use. In all tables in this section, figures for disaggregated provider types do not add to the subtotals for group practices, medical doctors (MDs) and doctors of osteopathy (DOs) because providers of unknown certification status were included in the subtotals, and subtotals do not add to the total because medical facilities with no resident physician were included in the total. In all cases, the numbers of episodes seen by the "excluded" physician categories were small. Unless otherwise specified, the noncertified categories include outliers, as all outliers were noncertified. All tables in this section refer only to services provided by the 358 providers discussed in earlier chapters. All discussion of the use of injections or oral prescription drugs refers only to antibiotics, and all discussion of injections refers only to the use of intramuscular (IM) injections.

As noted above, quality-of-care criteria with respect to antibiotic use in these diseases are specified in Table 6.1. In the case of strep throat and otitis media, the minimal criteria included the possibility that no antibiotic was an acceptable therapy. For strep throat, that criterion was conditional on whether the number of throat or strep cultures was sufficiently high (≥ 30 per cent of all strep throat episodes seen by that provider type) to justify concluding that the diagnosis of strep throat was being used as a "rule-out" pending the result of the culture (which could, of course, show no strep infection). For otitis media, some episodes could reflect serous otitis media, which may not require an antibiotic. "No antibiotic therapy" was listed as the only acceptable therapy for acute URI and influenza because, given the algorithms by which services and visits were aggregated hierarchically into episodes, these episodes were very unlikely to have a bacterial etiology.

The quality-of-care criteria for laboratory work were based on the argument that at least a minimal level of throat or strep cultures (especially in children with a "sore throat") are necessary to make the diagnosis of strep throat accurately and, depending on the results of the culture, to prevent either the complications of that disease (by treating it) or the unnecessary use of antibiotics in children who have a viral infection (see the literature review in Chapter IV). Finally, a chest roentgenogram is an acceptable service in at least some people with bronchitis. Its use can be considered at least reasonable, but is by no means required, for all patients with bronchitis.

We did 2 sets of tests of statistical significance (using a t-test for the differences in means of 2 independent samples). The first test was to determine the level of significance of differences in the quality of care between the group practices§ on the one hand and the separate medical and osteopathic solo provider categories on the other. This was done for each diagnosis in each time period. The second set of tests was done to determine the level of significance in the change in quality of care between Period I and Period II for each disease and provider type. All reported levels of significance are for a one-tailed test; the hypotheses were that group practices provided higher levels of quality of care than all categories of solo providers and that Period II figures for quality of care were higher than those from Period I.

Distribution of Diagnosis-Specific Episodes

The distribution of episodes by type of disease clearly differed by physician type (solo or group practice, certified and noncertified MDs and DOs, and outlier status) (Table 6.5).‖ The following are striking examples from Period I. For bronchitis episodes, DOs saw 63 per cent and group practices only 4 per cent; the figures for otitis media were 41 and 20 per cent, respectively. MDs saw 52 per cent of all pharyngitis episodes and 29 per cent of all episodes of strep throat. In Period I DOs saw the largest fraction of episodes of all diagnoses except pharyngitis. Noncertified DOs (excluding outliers) saw a larger portion of these episodes than any other specific type of physician, but this proportion varied by disease. Noncertified DOs saw 34 per cent of the bronchitis episodes and 24 per cent of the pharyngitis episodes.

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§ This included both certified and noncertified groups. Certified groups were those in which most, if not all, members were board-certified; as noted earlier, the majority of group practice episodes were seen by 2 larger multispecialty clinics in which virtually all members were certified.

‖ We cannot disprove the contention that these differences were partially or entirely systematic variations in the choice of a diagnostic classification for the same condition across the different physician categories—e.g., what one category might typically call influenza another might typically call acute URI. However, as noted in the Discussion below, systematic biases in diagnosis specification were unlikely to be a major problem in testing the hypotheses stated above, especially those regarding changes over time.

The distribution of episodes by provider type was different in Period II. MDs saw the largest portion of episodes of acute URI and influenza in Period II. Group practices saw a larger fraction of the strep throat episodes in Period II compared with Period I (34 per cent compared with 24 per cent); this increase was accounted for by noncertified groups. A smaller proportion of strep throat episodes was seen by MDs (virtually all of the decrease being among outliers). Among DOs, outliers saw a higher fraction of strep throat episodes in Period II, and noncertified DOs other than outliers a smaller fraction.

Overall Use of Antibiotics in Disease-Specific Episodes

Table 6.6 describes the patterns of antibiotic use for these 6 conditions aggregated over all physician types. The disease-by-disease text below focuses only on the percentage of episodes receiving any antibiotic in either oral or injectable form, striking differences by physician type in disease-specific use of types of antibiotics, and important shifts between Periods I and II. The reader is referred to Appendix B, Tables 6A–13B, for detailed information on patterns of antibiotic use by provider category.

Strep Throat (Appendix B, Tables 6A, 6B). Of the 363 episodes of strep throat in Period I that were treated by the 358 providers considered in this study, 76 per cent involved use of some antibiotics: 35 per cent of episodes treated by group practices,# 79 per cent of those treated by MDs and 95 per cent of those treated by DOs. Fifty-eight per cent of all patients with strep throat received IM antibiotics, 55 per cent oral antibiotics. In Period II, the percentage of the 461 episodes treated with antibiotics was 83 per cent: 70 per cent of episodes treated by group practices,* 86 per cent of those treated by MDs and 93 per cent of those treated by DOs. Sixty-five per cent of all patients received IM antibiotics, 61 per cent oral antibiotics. The most marked change in patterns of use (see Table 6.6) was the shift to injectable LA penicillin with or without the use of oral antibiotics. Some drop in use of IM SA penicillin occurred except when it was given with oral penicillin.

Pharyngitis (Appendix B, Tables 7A, 7B). Of the 2,133 pharyngitis episodes in Period I, 83 per cent of the episodes involved use of antibiotics: 44 per cent of those treated by group practices, 81 per cent of those treated by MDs (outliers, 91 per cent) and 94 per cent of those treated by DOs (outliers, 98 per cent). Fifty-seven per cent of these episodes involved IM antibiotics, 63 per cent oral antibiotics. In Period II, of 2,067 episodes, 77 per cent involved antibiotics: 45 per cent of those treated by group practices, 80 per cent of those treated by MDs and 85 per cent of those treated by DOs; 29 per cent of the episodes involved IM antibiotics, 65 per cent oral.

The most notable features found in examination of antibiotic use for episodes of pharyngitis by provider type included the following (see also Table 6.6): 1) In Period I, in 30 per cent or more of all pharyngitis episodes, patients received injectable SA penicillin alone or in combination with other antibiotics; by Period II, this figure had dropped to about 4 per cent. In contrast, patients received only oral penicillin in 8 per cent of the episodes in Period I; 17 per cent in Period II. 2) Injectable LA penicillin with no oral antibiotic was used almost exclusively among group practices in Period I; its use increased in Period II, largely among DOs. Interestingly, injectable LA penicillin with several

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# This low percentage was accompanied by a high use of throat cultures and most likely reflects the use of this label as a presumptive diagnosis pending the result of a throat culture.

types of oral antibiotics (ampicillin, lincomycin or penicillin) was also used in Period II; the combination with ampicillin was observed among MD outliers and the combination with lincomycin among DO outliers. 3) Use of oral ampicillin alone (which was considered not an acceptable therapy for pharyngitis because the side effects of ampicillin are greater than those for penicillin) nearly doubled between the 2 periods (from 6 to 12 per cent of all episodes). 4) In Period I, use of injectable lincomycin was concentrated almost entirely among outlier DOs (e.g., injectable lincomycin with no oral antibiotic was used in 22 per cent of pharyngitis episodes treated by them). 5) A wide variety of inappropriate or questionable IM and oral antibiotic combinations was used in Period I, including injectable lincomycin with oral erythromycin, oral ampicillin, or oral penicillin (nearly exclusively by DOs) and injectable LA penicillin with oral sulfa or tetracycline. In general, use of lincomycin and the inappropriate antibiotic combinations (excluding the LA penicillin combinations noted above) disappeared by Period II.

Otitis Media (Appendix B, Tables 8A, 8B, 9A, 9B). Because indicated or contraindicated types of antibiotics for otitis media differ according to age, we disaggregated episodes for children ages 4 and younger, 5 through 7, and 8 and older. Because sample sizes were so small for the oldest group, those findings are not reported here.

Of the 393 episodes of otitis media among children 4 years of age and younger in Period I, the proportion of episodes in which patients received antibiotics was 81 per cent: group practices, 66 per cent; MDs, 82 per cent; and DOs, 92 per cent. Of the 150 episodes in the same age group in Period II, the figure was 77 per cent: group practices, 48 per cent; MDs, 88 per cent; and DOs, 89 per cent. Among children 5 to 7 years old, the proportions of episodes in which patients received antibiotics were somewhat lower than for the younger age group. In Period I, 75 per cent of 156 episodes received antibiotics: group practices, 33 per cent; MDs, 76 per cent; and DOs, 92 per cent. The figures for the 106 episodes in Period II were 78 per cent overall: group practices, 50 per cent; MDs, 82 per cent; and DOs, 84 per cent.

Two notable patterns were observed (see Table 6.6): Use of oral ampicillin alone remained constant for children 5–7 years old and increased for children younger than 4 years. Use of injectable LA penicillin alone or with ampicillin increased markedly in both groups.

Bronchitis (Appendix B, Tables 10A, 10B). Of the 1,637 episodes of bronchitis in Period I, 79 per cent involved antibiotics; the range of episodes in which antibiotics were used was from 37 per cent for group practices to 96 per cent for outlier DOs. In 49 per cent of all bronchitis episodes, patients received IM antibiotics; in 62 per cent, oral antibiotics.

Of the 1,111 episodes of bronchitis in Period II, 65 per cent involved use of antibiotics: 46 per cent of episodes treated by group practices, 59 per cent of those treated by MDs, 71 per cent of those treated by DOs and 81 per cent of those treated by DO outliers. Altogether, 11 per cent involved IM antibiotics; 62 per cent, oral antibiotics.

Some use of injectable SA penicillin alone was observed in Period I (see Table 6.6), principally among MD outliers. IM lincomycin with or without an oral antibiotic was used in approximately 29 per cent of all DO episodes, and oral lincomycin without injectable lincomycin in another 5 per cent of DO episodes. The highest use of lincomycin was among DO outliers, who treated about two-thirds of their bronchitis episodes with lincomycin.

The range of injectable and/or oral antibiotics used in bronchitis was substantially reduced by Period II. As with the preceding diagnoses, use of lincomycin in any form nearly disappeared by Period II. In addition, the use of injectable SA

TABLE 6.5. Distribution of Episodes by Type of Provider, Diagnosis and Period

	Strep Throat				Otitis Media				Pharyngitis			
	Period I		Period II		Period I		Period II		Period I		Period II	
Type of Provider	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Group*	88	24	157	34	169	20	99	19	183	9	267	13
Noncertified	4	1	77	17	24	3	29	6	17	1	92	4
Certified	71	21	61	13	131	16	60	12	129	6	118	6
MD*	106	29	80	17	317	38	203	39	1,105	52	975	47
Outlier†	53	15	14	3	67	8	29	6	374	18	328	16
Noncertified‡	31	9	37	8	128	15	76	15	480	23	399	19
Certified	20	6	26	6	117	14	89	17	228	11	211	10
DO*	169	47	224	48	344	41	209	41	819	38	800	39
Outlier†	47	13	130	28	51	6	23	4	187	9	163	8
Noncertified‡	104	29	78	17	224	27	160	31	502	24	543	26
Certified	5	1	16	3	59	7	26	5	115	5	94	5
Total§	363		461		830		511		2,133		2,067	
Grand Total	368		482		898		581		2,250		2,220	

* Includes episodes seen by facilities with no resident physician or by providers with unknown certification status.

† Outliers are a separate (noncertified) category for MDs and DOs.

‡ Note that outliers are *excluded* from these rows.

§ Includes only episodes seen by the 358 providers who gave more than 100 ambulatory visits in the first 2 years of the study.

penicillin with no oral antibiotic dropped by Period II.

Influenza (Appendix B, Tables 11A, 11B). The number of episodes of influenza among all ages in Periods I and II was relatively small. Of the 502 influenza episodes in Period I, 71 per cent involved antibiotics: group practices, 22 per cent; MDs, 64 per cent; and DOs, 86 per cent. Forty-five per cent involved IM antibiotics; 50 per cent, oral antibiotics. Of the 305 episodes in Period II, 53 per cent involved antibiotics: group practices, 40 per cent; MDs, 50 per cent; and DOs, 63 per cent. Fourteen per cent of all influenza episodes in Period II received IM antibiotics; 48 per cent, oral antibiotics. As with all other diagnoses, the use of lincomycin (in either injectable or oral form) was markedly reduced by Period II (Table 6.6).

Acute URI (Appendix B, Tables 12A, 12B). Of the 2,106 episodes of acute URI in Period I, 64 per cent received antibiotics: group practices, 22 per cent; MDs, 57 per cent; and DOs, 86 per cent. Thirty-eight per cent received IM antibiotics; 49 per cent, oral antibiotics. In Period II, of 1,363 episodes, 49 per cent involved antibiotics: group practices, 19 per cent; MDs, 48 per cent; and DOs, 62 per cent. Eight per cent received IM antibiotics; 45 per cent, oral antibiotics.

In Period I, use or nonuse of antibiotic medications, as well as the type and number of antibiotics selected, varied by provider type. For example, among the group-practice acute URI episodes that received some antibiotic medication, the principal choices were oral antibiotics or injectable SA or LA penicillin. MD and

TABLE 6.5. Continued.

Bronchitis				Acute URI				Influenza			
Period I		Period II		Period I		Period II		Period I		Period II	
No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
69	4	62	6	325	15	170	12	46	9	38	12
21	1	40	4	53	3	54	4	14	3	10	3
42	3	19	2	211	10	85	6	28	6	14	5
540	33	380	34	826	39	670	49	186	37	151	50
135	8	88	8	129	6	159	12	59	12	71	23
244	15	184	17	388	18	347	25	79	16	42	14
149	9	99	9	258	12	130	10	44	9	35	11
1,024	63	664	60	933	44	482	35	260	52	114	37
378	23	73	7	234	11	121	9	37	7	16	5
560	34	522	47	664	32	352	26	197	39	91	30
37	2	69	6	30	1	9	1	3	1	7	2
1,637		1,111		2,106		1,363		502		305	
1,667		1,136		2,234		1,463		542		344	

DO outliers showed a substantial propensity for using injectable SA penicillin with no oral antibiotics; DO outliers also used (with some frequency) injectable lincomycin with no oral antibiotic. The variation by provider type in use of IM antibiotics for URI was markedly reduced by Period II.

Quality of Care by Diagnosis and Physician Type

This section presents the results of applying the quality-of-care criteria for minimal care as listed in Table 6.1 to the episodes of these 6 conditions for the various categories of physicians. Table 6.7 gives the percentages of episodes that met these minimal criteria for each physician category in each period. Group practices include both board-certified and noncertified groups; in this table noncertified categories for MDs and DOs include outliers. The total number of episodes on which these percentages are based can be found in the respective Appendix tables (Tables 6A–12B).¶ Table 6.7 contains 2 sets of significance tests—one for the differences between group practices and all other physician categories, and the second for the differences between Periods I and II for each physician category.

Strep Throat. The criteria for adequate quality of care of strep throat (Table 6.1) included "no antibiotic treatment" only if 30 per cent or more of the provider type's episodes had a throat culture (group practices in both periods, certified MDs in

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¶ Applying the criteria in Table 6.1 to the data in Appendix B, Tables 6A–12B will not in all cases produce exactly the results in Table 6.7. This is because the percentages in Table 6.7 were calculated by summing the number of episodes treated correctly and then dividing by the number of episodes, not by figuring the percentages of episodes treated by the various antibiotic medications and then summing. The latter approach would likely give different results for those provider/disease combinations in which the total number of episodes is small.

TABLE 6.6. Per Cent of Episodes in Which Specific Types of Injectable and Oral Antibiotics were Used, by Type of Antibiotic, Diagnosis, and Period

	Strep Throat		Pharyngitis		Otitis Media (0–4)	
Injectable/Oral Drug*	I† (N = 363)	II† (N = 461)	I (N = 2,133)	II (N = 2,067)	I (N = 393)	II (N = 150)
None/none	24	17	17	23	19	23
SA penicillin/none	9	5	12	2	4	
Ampicillin/none					1	
Tetracycline/none						
Lincomycin/none	4		3		2	
LA penicillin/none	6	14	2	8	4	5
None/penicillin	4	7	8	17	8	6§
None/ampicillin	5	5	6	12	15	21§
None/tetracycline	3	1	3	9	2	4
None/lincomycin				1		1
None/erythromycin	1	1	4	5	4	4
None/sulfa					1	1
None/all other antibiotics						4
SA penicillin/penicillin	6	6	8	1	1	
SA penicillin/ampicillin	6	2	7	1	5	3
SA penicillin/tetracycline	6		3		2	
SA penicillin/lincomycin						
SA penicillin/erythromycin					1	1
Tetracycline/penicillin						
Tetracycline/tetracycline			1			
Tetracycline/lincomycin						
Lincomycin/penicillin			1		1	
Lincomycin/ampicillin	4		2		3	
Lincomycin/tetracycline	3		4		2	
Lincomycin/lincomycin	1					
Lincomycin/erythromycin						
LA penicillin/penicillin		5		1		
LA penicillin/ampicillin		16		4		13
LA penicillin/tetracycline		4				
LA penicillin/lincomycin				2		
LA penicillin/sulfa	1				7	3
LA penicillin/erythromycin		1				
Ampicillin/penicillin					1	1
Ampicillin/ampicillin						
Per cent of episodes accounted for by these categories	90	91	88	93	88	95

SA: short-acting; LA: long-acting.

* Antibiotic before the slash (/) was an injection, after the slash a filled prescription.

† I: Period I; II: Period II.

TABLE 6.6. Continued.

Otitis Media (5–7)‡		Bronchitis		Influenza		Acute URI	
I (N = 156)	II (N = 106)	I (N = 1,637)	II (N = 1,111)	I (N = 502)	II (N = 305)	I (N = 2,106)	II (N = 1,363)
25	22	21	35	29	47	36	51
8	2	8	1	8	2	9	2
				2			
3		6		7		2	
3	9		1	1	1	1	1
8	14	7	7	4	7	5	11
10	10	5	15	7	9	8	8
2	2	9	22	8	13	6	9
1	3	1	1	1			1
5	6	2	3	2	5	3	7
			1		1		1
6		2		1	1	7	
5	5	2		2		3	1
1		2		1		2	
		2					
	1	1				1	
		1					
				3			
				1			
1		4					
1		6		3			
		1		1			
1		1		1			
	13						
2							
1				1			
92	95	90	91	91	90	89	96

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‡ Because of small numbers, episodes of otitis media occurring in people older than 7 years are not considered further in this monograph.

§ An additional 1 per cent was the combination of oral ampicillin and penicillin without an injectable antibiotic.

TABLE 6.7. Summary of the Percentage of Episodes with Appropriate Use of Antibiotics, by Period, Type of Provider, and Diagnosis

Period	Total	Total Groups	Outlier Noncertified MDs*	All Noncertified MDs*	Certified MDs	Outlier Noncertified DOs*	All Noncertified DOs*	Certified DOs
Streptococcal Sore Throat								
I	36	88	4†	20‡†	30‡†	4‡†	17†	21†
II	42	56§	43‡§	53§	81‡§	16†‖	29†‖	6‡#
Pharyngitis								
I	41	80	19†	42†	60†	16†	27†	24†
II	56§	76	38†§	53†§	76§	37†§	48†§	20†
Otitis Media, Ages 0–4								
I	44	72	13‡†	37†	54¶	0‡†	24†	5‡†
II	55‖	71‡	25‡	30‡#	68‡	43‡‖	65‡§	60‡‖
Otitis Media, Ages 5–7								
I	64	96‡	31‡†	68‡#	78‡¶	10‡†	43‡†	47‡†
II	78‖	100‡	70‡¶	58‡#	80‡	40‡#	82‡§	50‡
Bronchitis**								
I	42	75	41†	65	79	<0.5†	23†	49‡#
II	81§	89‖	81§	84§	87	40†§	78§¶	87§
Influenza								
I	29	78‡	19†	34†	47‡#	5‡†	15†	66‡
II	47§	60‡	43††	45‡	61‡	11‡#	40§¶	42‡
Acute URI								
I	36	78	33†	44†	45†	2†	12†	56‡#
II	51§	81	55†§	52†††	54†	32†§	37†§	77‡

* Outlier physicians are shown as separate categories. Because they were all noncertified, they also are included in the "all noncertified" categories.

‡ Based on fewer than 50 episodes.

¶ Differences from group practices significant at $p < 0.05$.

# Differences from group practices significant at $p < 0.01$.

† Differences from group practices significant at $p < 0.001$.

‖ Differences between Periods I and II significant at $p < 0.05$.

†† Differences between Periods I and II significant at $p < 0.01$.

§ Differences between Periods I and II significant at $p < 0.001$.

** Because tetracycline is an acceptable therapy for bronchitis only in persons 8 years of age and older, all episodes in which tetracycline was used in children under 8 were subtracted before the summary percentages were calculated.

Period II). Using this set of criteria (Table 6.7), 36 per cent of all strep throat episodes in Period I and 42 per cent in Period II were appropriately treated. In Period I, group practices treated 88 per cent of strep throat episodes appropriately. The figure was lower for every other physician category, especially MD and DO outliers (both 4 per cent); all differences between group practices and other provider types were significant.** In Period II, group practices experienced a significant decline in quality of care, to 56 per cent of strep throat episodes being treated appropriately. This drop was apparently explained by an increase in the proportion of cases seen by noncertified groups that were treated with

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** Hereafter, the term "significant" means statistically significant at $p < 0.05$ or lower.

IM LA penicillin and oral ampicillin, which was judged as an unnecessary exposure to ampicillin. Quality of care improved in Period II for all solo practice categories except certified DOs. All improvements except that of certified MDs were statistically significant.

Pharyngitis. In Period I, 41 per cent of these episodes were correctly treated; by Period II, the figure was 56 per cent—a significant improvement. In Period I, 80 per cent of all group practice episodes were managed by one of the acceptable treatment regimens. Figures for all other physician types were significantly lower, substantially so in the case of outlier DOs (16 per cent) and outlier MDs (19 per cent). In Period II, 76 per cent of pharyngitis episodes were treated appropriately for all group practices and certified MDs; figures were lower for all other physician types, but less so than in Period I (although differences were still significant). The Period II figures show improvement in the use of appropriate therapeutic regimens in pharyngitis among all solo provider categories except certified DOs; the latter switched from reliance on IM SA penicillin to oral ampicillin and oral tetracycline, neither of which is an acceptable therapy for pharyngitis. In general, improvement was greatest among outliers.

Otitis Media. Acceptable therapies for otitis media included "none" only in cases where the otitis media was chronic (serous otitis media, rather than infectious). Assuming that all episodes not treated with an antibiotic were correctly treated, the proportion of otitis media episodes in children 4 and younger that were appropriately treated was 44 per cent in Period I and 55 per cent in Period II. The percentage of appropriately treated episodes was highest for group practices (see Table 6.7). The level of care provided by all other provider categories was significantly lower than that provided by group practices. (Figures in Period I for outlier MDs, outlier DOs and certified DOs are based on fewer than 50 episodes.) By Period II, the figures for appropriately treated episodes shifted somewhat: about the same for group practices and higher for all provider types except noncertified MDs (for whom the Period II figure was lower). (In all cases, the percentages were based on fewer than 50 episodes of otitis media being treated.)

For 5- to 7-year-old children, acceptable therapeutic possibilities are somewhat broader, but the distinction with respect to no antibiotic therapy still holds. Roughly the same patterns of appropriate use of medications by provider type observed for children 4 and younger were observed for those 5 to 7 years. Specifically, group practices treated the highest proportion of episodes correctly in Period I, followed by certified MDs, noncertified MDs, certified and noncertified DOs, and finally outlier physicians (see Table 6.7). Differences between group practices and outlier MDs and all DOs were significant. In general, all provider types improved their use of antibiotic medications for this condition between Periods I and II, but outlier MDs and DOs still treated a significantly lower percentage of their episodes correctly than did group practices.

Bronchitis. In Period I, 42 per cent of all bronchitis episodes were managed by one of the acceptable treatment regimens. By Period II, the figure was 81 per cent—again a significant improvement. In Period I, group practices used appropriate therapy in 75 per cent of their bronchitis episodes (see Table 6.7); only certified MDs treated a higher proportion appropriately. In Period II, 89 per cent of all episodes seen by group practices were treated appropriately. The figures were lower for all other providers, but significantly so for outlier DOs and all noncertified DOs. The improvements in antibiotic use for all provider types between Periods I and II were significant for all but certified MDs.

Influenza. No antibiotic use was the only acceptable therapeutic decision defined for influenza. This criterion was based on the known viral cause of influenza and the diagnostic ranking rule that was applied to these data (see Methods, above). Episodes eventually coded as influenza were very unlikely to have had a recognized bacterial component (or they would have been classified in one of the bacterial diagnoses); hence, they had little justification for antibiotic use.

Of the influenza episodes in Period I (see Table 6.7), the proportion not receiving antibiotics and thus treated appropriately was 29 per cent. The figure for Period II was 47 per cent; this represented a significant improvement. The proportion correctly treated in Period I ranged from 78 per cent (group practices) to 5 per cent (outlier DOs) (based on fewer than 50 episodes). Differences between groups and all solo providers except certified DOs were significant.

In Period II, the highest figure for episodes receiving no antibiotics was 61 per cent for certified MDs and 60 per cent for group practices; outlier DOs and MDs and all noncertified DOs had a significantly lower percentage of appropriately treated influenza episodes. The improvements in quality of care between Periods I and II were significant for outlier MDs and all noncertified DOs.

Acute URI. As with influenza, "no antibiotics" was the only acceptable antibiotic therapy for this condition, because of the ranking hierarchy for diagnoses used in this study and the viral etiology of URI. In Period I, the appropriate therapeutic choice was made in 36 per cent of all URI episodes and in Period II, 51 per cent. In Period I group practices used no antibiotics in 78 of their URI episodes; all other provider types used antibiotics inappropriately significantly more often (see Table 6.7). In Period II, all provider types had worse records than group practices for acute URI episodes (all but certified DOs significantly so). Improvements between Periods I and II were significant for all outliers and all noncertified physicians.

Summary Comparisons

If our hypothesis is correct that group practices gave better care overall, they should have a higher percentage of correctly treated episodes than the other physician types more than 50 per cent of the time (because by chance alone they could be better 50 per cent of the time). Of 42 possible comparisons between group practices and other provider types in Period I†† (6 physician types times 7 disease categories), we observed that group practices were better than solo practitioners in 41 (98 per cent), significantly so in 39 cases. This difference between expected and observed is significant ($p < 0.001$). In Period II, of the equivalent 42 pairs, 40 (95 per cent) showed better quality for groups than solo providers ($p < 0.001$), although only 21 such complications were significant.

Another simple way to summarize these findings is to look at the "relative advantage" of group practices over all other physician types combined, using as the metric the number of percentage points that group practices were higher than solo practitioners, averaged across all diseases and unweighted for numbers of episodes seen. For example, taking the 42 possible comparisons in Period I, group practices provided care that was, on average, 49 percentage points higher than the solo physician categories. By Period II, their relative advantage had fallen to 24 percentage points. This phenomenon reflects a desired reduction in the variance of quality of care provided while maintaining the comparatively high standards among the certified group practices.

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†† These comparisons are based on the percentages given in Table 6.7.

Similarly, if the EMCRO had had no effect, one would by chance alone expect improvements in one-half of the comparisons between Periods I and II. Of the 49 possible comparisons of Period I with Period II, we observed at least some improvement in use of antibiotics in 40 (82 per cent) ($p < 0.01$). Of the 49 Period I–II comparisons, 26 showed that care was significantly better in Period II.

Special Analyses

Tetracycline in Children Less Than 8 Years of Age. Use of tetracycline in either oral or IM form among children less than 8 years of age is an unacceptable therapy because of the high risk of dental complications. Generally speaking, *injectable* tetracycline was virtually never used among children less than 8 years of age for these diagnoses. By contrast, in Period I, *oral* tetracycline was used in 17 per cent of bronchitis episodes in children less than 8 years of age, 9 per cent of pharyngitis episodes and 6 per cent of acute URI episodes. Differences in the use of tetracycline by provider type within this age group in the 3 diagnoses with adequate sample size for such an analysis (pharyngitis, bronchitis, acute URI) are depicted in Table 6.8. In Period I, the use of tetracycline in children for these conditions occurred more frequently among DOs than MDs. The highest use of oral tetracycline in this age group was observed for MD and DO outliers and certified DOs. (Note that the noncertified category in these analyses, as opposed to those reported in Table 6.7, *excludes* outliers.)

Use of oral tetracycline dropped for all 3 diagnoses between the 2 periods—from 9, 17, and 6 per cent of all episodes of pharyngitis, bronchitis and URI to 5, 16 and 4 per cent, respectively—but significantly so only for pharyngitis. Use of oral tetracycline by group practices was confined generally to the small numbers of episodes seen by those group practices for which certification status was unknown (presumably noncertified) or by facilities with no resident physician. Thus, the use of tetracycline in children in Period II, although slightly lower than in Period I, was still unacceptably high among at least some provider types.

Two or More Classes of Antibiotics. A clinical appreciation of the magnitude of the unnecessary use of antibiotics in this population—which reinforces the conclusions expressed in earlier chapters about the EMCRO's effect on quality of care—can be gained from examining the data in Tables 6.9 and 6.10. Table 6.9 gives the percentages of episodes of the 3 most common respiratory conditions that were treated by more than 1 class of antibiotics (e.g. tetracycline and penicillin, penicillin and ampicillin, penicillin and lincomycin). For all 3 conditions, combinations of different antibiotic classes would rarely be a recommended therapeutic strategy.

In Period I, about one-quarter of all episodes of pharyngitis and bronchitis, and about one-fifth of all episodes of URI, were treated with 2 or more classes of antibiotics. Group practices and certified MDs rarely used more than 1 class of antibiotics to treat these common conditions, whereas outliers rather frequently resorted to such combinations. Even about one-fifth of patients with acute URI treated by outlier and noncertified DOs received more than 1 class of antibiotics. Thus, "polypharmacy" with respect to antibiotics was quite evident in Period I among some types of physicians.

By Period II, the use of multiple classes of antibiotics for these respiratory infections had decreased to almost 1 in 7 of pharyngitis episodes and 1 in 20 to 30 for bronchitis and URI episodes. Outlier DOs, however, continued to practice a high degree of polypharmacy for these conditions.

Lincomycin in Selected Conditions. Table 6.10 presents data on the use of lincomycin in pharyngitis, bronchitis, and

TABLE 6.8. Per Cent of Episodes Among Children Under 8 in which Tetracycline was Used, by Diagnosis, Period, and Type of Provider

Diagnosis, Time Period and Use of Tetracycline	Total	Total Groups	Total MDs	Outlier Noncertified MDs	Other Noncertified MDs[*]	Certified MDs	Total DOs	Outlier Noncertified DOs	Other Noncertified DOs[*]	Certified DOs
Pharyngitis										
Period I										
Number of episodes	1,043	91	532	158	244	121	411	107	247	53
Per cent injectable	1	—	<0.05	—	1	—	1	—	3	—
Per cent oral	9	—	9	25	3	—	11	22	6	9
Period II										
Number of episodes	660	84	309	82	136	84	225	70	152	33
Per cent injectable	—	—	—	—	—	—	—	—	—	—
Per cent oral	5[†]	3	2[†]	1[‡]	4	1	9	4[†]	7	24
Bronchitis										
Period I										
Number of episodes	843	37	277	59	125	87	527	185	290	24
Per cent injectable	—	—	—	—	—	—	—	—	—	—
Per cent oral	17	—	5	3	6	4	25	30	24	4
Period II										
Number of episodes	397	19	119	10	63	42	256	31	193	32
Per cent injectable	—	—	—	—	—	—	—	—	—	—
Per cent oral	16	10	15	—	15	21[§]	17	3[§]	19	21
Acute URI										
Period I										
Number of episodes	1,017	176	402	59	179	142	428	100	307	17
Per cent injectable	1	—	—	—	—	—	4	—	6	—
Per cent oral	6	—	6	11	5	4	9	3	10	17
Period II										
Number of episodes	439	66	221	60	95	50	141	35	101	5
Per cent injectable	—	3[‖]	—	—	—	—	—	—	—[§]	—
Per cent oral	4	—	4	4	8	—	6	5	5	19

[*] Note that outliers are *excluded* from these columns.

[§] Differences between Periods I and II significant at $p < 0.05$.

[†] Differences between Periods I and II significant at $p < 0.01$.

[‡] Differences between Periods I and II significant at $p < 0.001$.

[‖] Only among the 13 episodes in groups with unknown certification status or no resident physician.

TABLE 6.9. Percentage of Episodes Treated with 2 or More Classes of Antibiotics, by Diagnosis, Period and Type of Provider

Diagnosis and Period	Total	Total Groups	Outlier Noncertified MDs	All Noncertified MDs	Certified MDs	Outlier Noncertified DOs	All Noncertified DOs	Certified DOs
Pharyngitis								
Period I	27	4	52	26	7	44	39	42
Period II	15	2	28	16	5	49	23	2*
Bronchitis								
Period I	26	6	17	11	3	55	37	35
Period II	5	3*	5	3	0	42	8	0
Acute URI								
Period I	18	3	23	10	3	21	24	3*
Period II	3	1	2	2	1	22	6	0*

* Based on fewer than 50 cases.

acute URI episodes. As indicated previously, lincomycin is a potent antibiotic with serious side effects whose use is rarely if ever indicated for outpatient treatment of these common conditions. In Period I, 16 per cent of pharyngitis, 27 per cent of bronchitis, and 7 per cent of acute URI episodes were treated with lincomycin. Use was disturbingly high among outlier DOs, who treated about one-half of pharyngitis episodes and two-thirds of bronchitis episodes with some form of lincomycin.

By Period II, total use of lincomycin had declined remarkably, to 6 per cent for pharyngitis, 4 per cent for bronchitis and 2 per cent for URI. Use among outlier DOs also declined sharply, although not to levels considered acceptably low.

Quality of Care by Primary Care Specialty. The majority of episodes of these 6 infectious diseases were seen by solo physicians in general practice (who should not be confused with board-certified physicians in family practice). As a result, detecting differences in quality of care by

TABLE 6.10. Percentage of Episodes Treated with Either Oral or Injectable Lincomycin by Diagnosis, Period and Type of Provider

Diagnosis and Period	Total	Total Groups	Outlier Noncertified MDs	All Noncertified MDs	Certified MDs	Outlier Noncertified DOs	All Noncertified DOs	Certified DOs
Pharyngitis								
Period I	16	1	22	10	4	59	31	8
Period II	6	3	2	2	3	32	12	4*
Bronchitis								
Period I	27	3	3	2	4	69	43	8
Period II	4	0	2	3	1	23	0	3
Acute URI								
Period I	7	1	8	3	1	15	10	3*
Period II	2	1	1	1	3	8	4	0*

* Based on fewer than 50 cases.

specialty was difficult. Because of the large number of episodes of pharyngitis, however, we attempted to use it as an example of how quality of care seemed to differ among primary care physicians. For both MDs and DOs, about two-thirds of all pharyngitis episodes were seen by general practitioners (GPs). The numbers of episodes seen by other types of specialists, however, varied widely between MDs and DOs (Table 6.11). For example, MDs who stated that they were obstetrician/gynecologists (OB/GYNs) saw almost no episodes of pharyngitis in the New Mexico Medicaid program, whereas DOs in the same specialty saw a relatively large percentage of such episodes; the opposite relationship was observed for MD and DO pediatricians.

In Period I, MD specialties generally had a higher percentage of episodes treated appropriately than did comparable DO specialties. By Period II, the trend had largely disappeared. (See Appendix B, Tables 13A–13B, for a detailed description of antibiotics used by different specialty types for episodes of pharyngitis.)

Differences among specialists *within* the MD and DO category were somewhat harder to decipher. For comparison purposes, the level of care given by GPs was used as the basis for testing differences among specialists. (Statistical significance levels using GPs as the base are shown in Table 6.11.) In Period I, MD physicians in pediatrics, internal medicine and surgery all gave significantly better care than did MD GPs. (Pediatricians, moreover, gave significantly better care than internists or general surgeons.) DO physicians in internal medicine and OB/GYN gave better care than DO GPs. (DOs in OB/GYN also gave significantly better care than DOs in pediatrics and surgery.)

TABLE 6.11. Summary of Percentage of Pharyngitis Episodes Treated Appropriately, by Primary Care Specialty and Period

Primary Care Specialty	Period I		Period II	
	Number and Per Cent of Episodes*	Percentage Treated Appropriately	Number and Per Cent of Episodes*	Percentage Treated Appropriately
MD				
General practice	733 (66)	36†	622 (64)	54†
Internal medicine	77 (7)	49‡	111 (11)	60
Pediatrics	165 (15)	68†‖	151 (15)	59
Obstetrics/gynecology	9 (1)	55	0 (0)	0
General surgery	117 (11)	48†§	83 (9)	68§
DO				
General practice	558 (68)	17†	553 (69)	44†
Internal medicine	6 (1)	66‖	5 (1)	78
Pediatrics	15 (2)	6†	19 (2)	62
Obstetrics/gynecology	118 (14)	51‖	185 (23)	32§
General surgery	112 (14)	23†	32 (4)	60‡

* The percentage of all pharyngitis episodes in Periods I and II seen by MDs (1105; 975) or DOs (819; 800) in these five primary care specialties is given in parentheses.

† Differences between like categories of MD and DO specialists significant at $p < 0.001$, one-tailed test; all other differences not significant.

‡ Differences between general practitioners (GPs) and specialists within MD and DO categories significant at $p < 0.05$.

§ Differences between GPs and specialists within MD and DO categories significant at $p < 0.01$.

‖ Differences between GPs and specialists within MD and DO categories significant at $p < 0.001$.

By Period II, most of these distinctions had disappeared. This convergence of levels of quality of care is reflected in the observation that between Periods I and II most primary care specialty types improved the care they gave for patients with pharyngitis. For MDs, every category except pediatricians improved (significantly so for GPs and surgeons). The explanation for the drop in the percentage of episodes of pharyngitis appropriately treated by pediatricians appeared to be a shift away from the use of oral erythromycin in favor of oral ampicillin.

For DOs, all providers except OB/GYNs improved their performance (significantly so for all but internal medicine). The decline in the quality of care for OB/GYN may be explained by the disappearance of the use of the combination of IM and oral penicillin (which was considered an acceptable therapy for pharyngitis). In addition, OB/GYNs seemed to shift to using IM LA penicillin with oral lincomycin, which is unacceptable on the grounds that 2 antibiotic types are being used and that lincomycin should not be used for this condition at all.

These findings on primary care specialty are too mixed and limited to lend themselves to definitive interpretation about the relationship between quality and specialty per se. Two tentative conclusions might be put forth, however. First, this analysis suggests that the MD/DO distinction persists for the class of physicians self-described as GPs but less so (if at all) for those self-described in one or another specialty. Second, the range of percentages of episodes treated appropriately *both* rose and became smaller by Period II, reaffirming the general view that the variance in care as a function of physician type was reduced for this Medicaid population.

Quality of Care by Use of Laboratory Tests

We used disease-specific quality-of-care criteria for laboratory tests that were much less specific than those for antibiotics. This decision was taken because there is no universal agreement as to the level of quality of care represented by even as basic a step as throat cultures in streptococcal infections (see Chapter IV), although most observers indicate that some use of certain laboratory tests for these conditions is certainly warranted. We took the view simply that a throat or strep culture, a white blood cell count (WBC) or a complete blood cell count (CBC) would be a "relevant" test in upper respiratory tract infections such as a strep throat or pharyngitis. Similarly, chest roentgenography or a WBC/CBC in bronchitis would be "relevant" diagnostic procedures. Because these tests have virtually no risk of side effects (for persons with these common conditions) and can be expected to provide useful information, our basic premise was that higher quality of care was represented by the episodes *with* "relevant" diagnostic procedures.

The assumptions about the use of laboratory tests and their relationship to quality of care are roughly the same for pharyngitis and for strep throat. Throat and strep cultures are recommended by many experts as essential in determining whether the cause of the sore throat is bacterial or viral (as noted in Chapter IV). A WBC can be useful because a high count may indicate a bacterial etiology and because the results can be obtained immediately (in contrast to the day or longer needed to obtain results from a throat culture).

Table 6.12 illustrates the use of these selected tests for each disease in each time period. In Period I, by far the greatest use observed for throat cultures was for strep throat, but still only 21 per cent of all sore throats labeled as strep throat were cultured. Use of laboratory tests in strep throat varied markedly by provider type. For example, 81 per cent of all strep throat episodes seen by group practices received a throat culture (compared with 5 per cent for all MDs and none for all DOs).

In Period II, use of cultures in strep throat declined significantly among episodes seen by group practices (to 44 per cent) and increased significantly among those seen by MDs. This finding is explained by the low level of use of throat cultures by *noncertified* groups, accompanied by the substantial rise in the number of episodes diagnosed as strep throat by these providers. Thus, the drop in use of throat cultures is not characteristic of the practice of the large certified group practices. Use of WBCs in strep throat was low in both periods but their use rose slightly for group practices and MDs between the 2 time periods.

In Period I, overall use of cultures in pharyngitis was only 4 per cent, and ranged from 33 per cent for group practices (43 per cent for the certified group practices) to 3 per cent or less for any MD or DO solo practice category (and none among DO outliers). Use of WBCs was uniformly low (3 per cent or less among all physician categories).

The overall rise in throat cultures in pharyngitis episodes between Periods I and II (from 4 to 11 per cent) was brought about largely by the increase in their use among solo-practice physicians (MDs more than DOs, and all certified physicians more than noncertified). In general, little change in the use of WBCs was observed between the 2 time periods except for a significant increase in their use among group practices.

Use of laboratory tests for otitis media was quite low in both periods, except for throat cultures (which were done almost exclusively by group practices). MD and DO outliers used no laboratory tests at all among the few cases of otitis media that they treated.

Throat cultures and WBCs might be considered useful diagnostic steps in bronchitis for reasons similar to those for other respiratory infections; in addition, chest roentgenograms can be an important diagnostic tool in helping to distinguish patients with pneumonia from those with bronchitis. Cultures and WBCs were used very infrequently by any physician type in either period. In Period I, group practices used chest roentgenography in 19 per cent of their bronchitis episodes. Apart from MD outliers, who used chest roentgenography in 8 per cent and WBCs in 7 per cent of bronchitis episodes, use of laboratory tests in patients with bronchitis by any other provider type was very low in Period I. In Period II, the highest use of chest roentgenography was again among group practices (10 per cent), although this was lower than in Period I. Use of chest roentgenography rose significantly for outlier and noncertified DOs, but was still quite low (about 4 per cent of all episodes).

No particular laboratory tests would be considered mandatory in episodes of influenza or acute URI. Some might be considered acceptable in cases where other potential diagnoses might need to be eliminated, chiefly throat cultures and WBCs to rule out bacterial disease. Use of laboratory tests in influenza was extremely low in both periods but higher in Period II than I. Only group practices used throat cultures in Period I; WBCs were used chiefly by MDs. In Period II, use of throat cultures was still low, but group practices and all MDs increased their use of WBCs significantly. Typically, the highest percentage of acute URI episodes with either throat cultures or WBCs in both time periods was among group practices. Use of these laboratory tests increased between the 2 periods, chiefly among MDs, but again overall use of both tests in both periods was very low.

In summary, group practices uniformly used common laboratory tests more often, across all conditions, than any other physician type. Generally, use of tests rose between the 2 periods, but in most cases only to levels that still seem rather low, especially for patients with a sore throat who were diagnosed as having either strep throat or pharyngitis. Unlike the extremely high rate of overuse of antibiotic medications that was found in this study, especially in Period I, no corresponding overuse of common laboratory tests was discovered.

Quality of Care by Revisit Rates

One major tenet of primary care is good follow-up and continuity of care.[93] For these common conditions, however, resolution of the illness should typically occur within 1 to 2 weeks, and follow-up visits are usually not needed. Revisits in episodes of otitis media within 6 weeks, however, are typically recommended, to make sure that the infection has been completely eliminated and that, even though the patient is asymptomatic, no fluid remains in the ear. Thus, we ascertained whether revisit rates for otitis media differed by type of provider. Revisits were counted any time between 7 days and 6 weeks following the initial visit in the otitis media episode in 2 ways: 1) if they were made to any physician for the diagnosis of otitis media explicitly, or 2) if they were made to the doctor who treated the otitis media initially for any reason. This latter rule was based on the assumption that if a child returned to the same physician for almost any reason, the physician would still check the ears for the presence of fluid.

Using the 6-weeks specification (Table 6.13), 504 otitis media episodes were seen in Period I, and 144 (29 per cent) received at least 1 revisit 7 days to 6 weeks after the episode began. This rate varied slightly by provider (although some figures are based on small numbers of episodes), but the highest revisit rates were for group practices (37 per cent), noncertified DOs (35 per cent) and certified MDs (27 per cent). Outliers and noncertified MDs had rates significantly lower than group practices. Revisit rates seemed to drop slightly by Period II, mostly among physician categories with higher rates in Period I. The most notable exception was for noncertified MDs, whose revisit rate rose significantly between the 2 time periods.

Summary: Quality-of-Care Evaluation

The principal hypotheses in these analyses were as follows: 1) quality scores would be higher in Period II than I; 2) all solo physicians would have lower levels of quality than group practices; 3) outliers (as defined by use of all injections) would have the poorest records in use of IM and oral antibiotics in these specific respiratory diseases; and 4) physicians who were worst in Period I would improve the most (i.e., the variance in care would decrease). In general, these hypotheses were confirmed.

The first major finding of this study, however, related to the general levels of care as assessed by antibiotic use across all diagnoses. The percentages of episodes treated appropriately ranged widely, depending on the disease. In Period I, for example, influenza episodes (taking all provider types together) were treated appropriately 29 per cent of the time, whereas episodes of otitis media in 5- to 7-year-olds were treated appropriately 64 per cent of the time. By Period II, the range had shifted upward. Strep throat, the lowest, was treated correctly 42 per cent of the time, and bronchitis was highest at 81 per cent. Improvements between the 2 periods were significant for all conditions but strep throat. These findings were all consistent with the first hypothesis.

One way of summarizing these findings is to look at the improvement achieved (as a percentage of the improvement possible). This is basically the following ratio: percentage correctly treated in Period II (PC II) minus the percentage correctly treated in Period I (PC I), all divided by the percentage of improvement that could have been achieved (100 per cent − Period I per cent), or (PC II − PC I)/(100 − PC I). Looked at in this fashion, across *all* episodes, bronchitis improved the most, 67

TABLE 6.12. Proportion of Episodes in which Selected Laboratory Tests Were Used, by Period, Type of Provider and Diagnosis

Period and Test	Total	Total Groups	Total MDs	Outlier Noncertified MDs	Other Noncertified MDs	Certified MDs	Total DOs	Outlier Noncertified DOs	Other Noncertified DOs	Certified DOs
Streptococcal Sore Throat										
Period I										
Throat or strep culture	.21	.81	.05	—§	.10	.05	—	—	—	—
Complete/white blood count	.02	.07	.01	—	—	—	—	—	—	—
Period II										
Throat or strep culture	.21	.44*	.30*	—	.32	.46†	.03	.01	.05	.06
Complete/white blood count	.04	.10	.04	—	—	.04	<0.005	—	.01	—
Pharyngitis										
Period I										
Throat or strep culture	.04	.33	.02	.01	.03	.03	<0.005	—	<0.005	.01
Complete/white blood count	.01	.02	.01	.02	—	.01	.01	.03	.01	.02
Period II										
Throat or strep culture	.11*	.29	.10	—	.15*	.18*	.06	—	.08*	.08†
Complete/white blood count	.02†	.08†	.03	.01	.02	.03	.01	—	.01	—
Otitis Media—Ages 0–4										
Period I										
Throat or strep culture	.03	.11	.01	—	.01	—	—	—	—	—
Complete/white blood count	.01	.04	—	—	—	—	—	—	—	—
Period II										
Throat or strep culture	.20*	.17	—	—	—	—	.43	—	.56*	—
Complete/white blood count	.01	—	.02	—	—	.03	—	—	—	—
Otitis Media—Ages 5–7										
Period I										
Throat or strep culture	.02	.11	—	—	—	—	—	—	—	—
Complete/white blood count	—	—	—	—	—	—	—	—	—	—
Period II										
Throat or strep culture	.13‡	.21	.02	—	.06	—	.24	—	.30‡	—
Complete/white blood count	.02	—	.04	—	—	—	—	—	—	—

					Bronchitis					
Period I										
Chest x-ray	.02	.19	.03	.08	.01	.01	—	—	—	—
Throat or strep culture	<0.005	—	<0.005	—	<0.005	—	—	—	—	—
Complete/white blood count	.01	.01	.02	.07	—	.02	<0.005	.01	<0.005	—
Period II										
Chest x-ray	.04‡	.10	.03	.03	.03	.04	.03	.04*	.03*	—
Throat or strep culture	.01	.02	.02	—	.02	.04	<0.005	—	<0.005	—
Complete/white blood count	.01	.02	.02	.02	.01	.01	.01	—	.01	.01
					Influenza					
Period I										
Throat or strep culture	<0.005	.04	—	—	—	—	—	—	—	—
Complete/white blood count	.01	—	.03	.02	.01	.07	<0.005	—	.01	—
Period II										
Throat or strep culture	.01	.03	.01	—	.02	.03	.01	—	.01	—
Complete/white blood count	.06*	.13†	.09†	.10	—	.11	—	—	—	—
					Acute URI					
Period I										
Throat or strep culture	.04	.18	.01	—	.02	—	—	—	.01	—
Complete/white blood count	.02	.05	.01	.05	—	.01	—	—	.01	—
Period II										
Throat or strep culture	.06†	.16	.07*	—	.11*	.05†	.01	.01	—	.11
Complete/white blood count	.02	.05	.03‡	.02	.01	.02	—	.01	—	—

† Differences between Periods I and II significant at $p < 0.01$.
‡ Differences between Periods I and II significant at $p < 0.001$.
* Differences between Periods I and II significant at $p < 0.0001$.
§ Dash (—) means no laboratory test was observed.

TABLE 6.13. Number and Per Cent of Episodes of Otitis Media in which a Revisit Occurred within 6 Weeks, by Type of Provider and Period

Type of Provider	Period I			Period II		
	Number of Episodes†	Episodes with Revisits		Number of Episodes	Episodes with Revisits	
		Number	Per Cent		Number	Per Cent
Total*	504	144	29	267	68	25
Group practices	101	37	37	50	15	30
Outlier noncertified MDs‡	37	7	19§	17	5	29
All noncertified MDs	120	22	18‖	52	17	33#
Certified MDs	71	19	27	48	11	23
Outlier noncertified DOs‡	32	9	28	14	4	29
All noncertified DOs	165	58	35	101	23	23#
Certified DOs	38	7	18§	10	2	20

* Total includes physicians for whom certification status is unknown.

† Episodes are for 6-week time frames and for patients of all ages. For definition of revisit, see text.

‡ Outliers are listed separately; because all outliers were noncertified they are also included in their respective noncertified categories.

§ Differences from group practices significant at $p < 0.05$.

‖ Differences from group practices significant at $p < 0.01$.

# Differences between Periods I and II significant at $p < 0.05$.

per cent of achievable; otitis media in 5- to 7-year-olds, 39 per cent; pharyngitis and influenza, both 25 per cent; acute URI, 23 per cent; otitis media in children 4 and younger, 20 per cent; and strep throat, 9 per cent.

Nevertheless, only about half of all episodes of these common diseases were being handled appropriately, even after the EMCRO had had its major effect on the use of antibiotic injections, and only 1 condition (bronchitis) showed anything like what might have been hoped for in the form of achievable improvement. Moreover, these findings were derived from an evaluation based on criteria for a *minimal* level of quality of care: episodes were classified hierarchically by diagnosis, the rules for assigning services gave physicians the benefit of the doubt, and the option of "no antibiotic therapy" was allowed in certain circumstances as an acceptable therapy in conditions normally considered to have a bacterial etiology.

Evidently, many episodes of these common respiratory conditions were receiving the wrong antibiotic or too many antibiotics, and many in Period II were still being treated unnecessarily with antibiotics; arguably, although we have no direct evidence, some may have not received antibiotics when they were indicated. These findings can be interpreted as a negative reflection of the level of basic care still encountered in this Medicaid population.

The second finding related to differences among provider types. Group practices had been hypothesized as giving better care than any other provider type, because the findings from the earlier (2-year) evaluation[7] showing this to be the case had been replicated in the results reported in the early chapters of this report. Hence, all tests of significance of differences between provider types used group practices as the basis of comparison, and assumed that physicians in solo practice would provide lower quality of care. Because the total of group practices included noncertified practices as well as the large multispecialty practices and clinics, the differences with solo providers are lower than would have been the case if only the latter were used as the comparison group. Moreover, the numbers of episodes seen by group practices is lower than for most other provider types; for example, groups saw only about 10 per cent of all influenza episodes and about 5 per cent of all bronchitis episodes. This means that the "average" level of care given to this population was much lower than that reflected in the figures for group practices, even though the latter have been extensively cited in this chapter. In any event, group practices gave care (as measured by use of antibiotic medications) typically equal to or better than any type of physician in solo practice in both time periods. Thus, the second hypothesis was generally confirmed.

The third hypothesis was that outlier physicians would give the poorest levels of care on these broader medications criteria, and this was borne out. MD and DO outliers gave consistently and markedly poor levels of care (especially compared with group practices) for all diseases in Period I; in Period II, MD outliers still gave significantly lower levels of care than group practices for half the conditions and outlier DOs for all but one. For example, even after the peer review intervention regarding use of injections, 60 per cent of bronchitis episodes seen by DO outliers were treated inappropriately, as were 63 per cent of their pharyngitis episodes, 84 per cent of their strep throat episodes and 89 per cent of their influenza episodes. Figures for MD outliers included 57 per cent of strep throat and influenza episodes and 62 per cent of pharyngitis still treated inappropriately in Period II, but only 19 per cent of episodes of bronchitis. Because MD outliers and (to a lesser degree) DO outliers decreased their use of *injectable* antibiotics substantially (see, e.g., Table 5.10), we concluded that this persistent deficiency in quality was attributable to the poor choice of oral medications, some unacceptable "polypharmacy," and continuing overtreatment. These figures are all the more startling because DO and MD outliers saw a substantial fraction of all the episodes of these diseases. For example, between them, MD and DO outliers saw about 25 per cent of all pharyngitis episodes, 30 per cent of strep throat, between 30 and 15 per cent of bronchitis (Periods I and II), and between 20 and 30 per cent of influenza (Periods I and II).

Findings as to other physician characteristics were mixed. Especially in Period I, DOs gave consistently poorer care than MDs. Comparisons of like groups (e.g., noncertified MDs and DOs; certified MDs and DOs) showed that for most diseases in both periods, MDs had a higher proportion of adequately treated episodes. In addition, when the MD/DO comparison was done by specialty (for pharyngitis), MD GPs gave significantly better care than DO GPs. (Small numbers of cases precluded rigorous comparisons in other specialties.)

Within the MD and DO categories, board-certified physicians sometimes, but not always, gave better care than noncertified physicians across all diseases. For example, in Period II, noncertified and certified MDs gave nearly the same level of care for bronchitis, influenza and URI; the same was true for DOs for bronchitis, influenza and otitis media in children 4 years old and younger. (Other differences for DOs were often based on extremely small numbers of cases treated by certified DOs.) Overall trends supported the hypothesis of better quality of care among the board-certified, especially for MDs.

The greatest improvements in the appropriateness of use of medications for these diseases were observed for DOs; these improvements were significant for about half the diseases studied (especially for noncertified DOs). Among MDs, the improvements in quality of care between the 2 periods were observed for nearly every condition, but were significant most often for outliers. These results tend to support the hypothesis that the most positive changes would be observed among the poorest performers (notwithstanding the finding that the care given by such physicians may still be at unacceptably low levels). This finding also means that the variance among providers was substantially reduced, which can be viewed as a definite improvement in the overall care to this population, whose access to the best physician is less than desirable.

Use of laboratory tests was extremely low in these conditions. For example, only about one-fifth of all strep throat episodes in Periods I and II received either a throat culture or a white blood cell count, yet the literature suggests that physicians can correctly make this diagnosis without such a test only about one-half of the time. Slight increases in the use of at least 1 relevant laboratory test were observed for all diseases over time except for strep throat. The patterns of use of laboratory tests by provider type were analogous to those for antibiotic use—namely, higher use of relevant tests by group practices and virtually no use by outliers. When quality of care was evaluated in terms of revisit rates in otitis media, less than two-fifths of all episodes had a required follow-up visit.

Discussion

Episode-of-Illness Methods

Empirically, establishing episodes of illness from a claims data base was somewhat complicated, because of the need for many decision rules as to the cohort to use, how to assign services properly to episodes by diagnosis, and so forth. Such efforts were made simpler by eliminating Medicaid aid categories of disabled or elderly populations and by selecting common, usually self-limited diseases. The methodologic work described in this report suggested that services had been assigned satisfactorily to episodes, and we judged that reasonable inferences could be drawn about the quality of care based on entire episodes of illness. From the point of view of developing a practical quality-of-care methodology, this is an important finding, because of the likely future need to rely more and more on such data sources.

Certain points as to the overall validity of this approach should be emphasized, however. First, because many algorithms for creating episodes of care were based on diagnoses, perhaps the most crucial problem is the degree of confidence that can be placed in diagnoses recorded on Medicaid claim forms, especially because, as some work suggests,[15, 70] information from health records is not always reliable. Because reliability in effect puts a ceiling on the level of achievable validity, this question was explored in several indirect ways.

In the preliminary analyses, an effort was made to see if physicians shifted diagnostic categories between Periods I and II to justify antibiotic injections for which payment would otherwise have been disallowed, as it might have been monetarily desirable to do so. No evidence of any substantial shifts in diagnosis recording was detected. Furthermore, it will be recalled that Medicaid claims for all services except prescription drugs were reviewed against guidelines that themselves were diagnosis-specific. Hence, illegible, odd, or implausible diagnoses were screened by clerical personnel and/or peer review physicians in the EMCRO and questionable diagnostic patterns were referred to the physicians giving the care for correction prior to final processing. In addition, the data set on which these analyses were based was unusually complete; the Medicaid fiscal intermediary at the time (The Dikewood Corporation) had developed sophisticated systems for checking and cleaning records, resulting in data of high quality. Further, in deriving the hierarchy of infectious disease diagnoses, a review of combinations of diagnoses appearing on single records (e.g., claims for office visits) did not yield worrisome combinations, suggesting that diagnoses were reasonably accurate.

A second problem arises from the question of multiple physicians giving care for a single episode. These respiratory illness episodes had, on average, less than one-fifth of an office visit in addition to the visit initiating the episode. This phenomenon meant that the most common pattern of care was a single office visit to 1 physician, with little or no input from other physicians. This in turn mitigated problems of analyzing the quality of care by physician characteristics in episodes treated by more than 1 provider.

A third issue arises regarding the simplicity of the quality-of-care criteria used. Quality-of-care assessment using insurance claim form data cannot be done with contingent criteria that might permit assessment of therapy in the context of, for example, diagnostic test results. Our criteria, however, were based on sound, up-to-date medical practice, were simple to understand, and were easy to apply. Moreover, they were written so as to give the benefit of the doubt to physicians with respect to use of antibiotic medications, meaning that our findings about deficient practices are conservative. In addition, differences in quality of care by physician type were consistent across the 6 diagnoses; the results based on medications criteria were also consistent with findings about use of relevant laboratory tests. Consequently, even given the rather serious constraints on the type of criteria that might be articulated for a quality-of-care study based on insurance claims data, the validity and applicability of these criteria appear to be within acceptable limits.

Fourth, the validity of generalizing findings from this study to the broader contexts of PSROs, the Medicaid population in general, or the U.S. population as a whole must be considered. Extrapolating from New Mexico to the national PSRO program is not without hazard, because much of the New Mexico Medicaid population, which is overwhelmingly white, is found in rural counties and because the environment in which the EMCRO operated was exceptionally conducive to successful peer review activities, especially those aimed at improving quality of care. Nevertheless, because the EMCRO's activities were generously funded, because the analyses were based on a cohort that did not change (except for aging), and because the longitudinal analyses are reasonably close to a true before/after study design, we believe that our findings will provide a valid benchmark by which to judge the likely upper level of accomplishment of any PSRO ambulatory care review effort.

Finally, episode methods probably cannot be widely extended at the moment, given the underdeveloped state of most data bases available to PSROs. Taking account of underlying disease may be difficult when the chief source of data is an insurance claim form; for example, space for recording relevant additional diagnoses may be limited or not completed by the physician, especially if he or she is not a "usual source of care" and thus may not know past medical problems. Moreover, episode techniques depend on accurately maintained data files organized on a person-by-person basis that contain all ambulatory care obtained by the individual.

Quality-of-Care Results

The findings on quality of care as evaluated by the episode-related criteria were important in several respects. First, the beneficial effect of the New Mexico EMCRO on injection use, especially antibiotics, was demonstrated to have been substantial and achieved with no decrement of the level of quality of care of other services. The decreases in use of potent injectable antibiotics, some of which are unacceptable therapies for certain diseases or in patients of specific ages, represented a clinically meaningful accomplishment.

This result confirms that areawide peer review organizations can play a major role in detecting and correcting problems in the quality of care and in maintaining higher levels of care thereafter.

The picture was not all bright, however. The earlier analyses based on ambulatory visits were restricted to injection use, and hence little light was shed on deficiencies in quality in other areas (even though some residual misuse of injections was detected). The analyses based on episodes, however, clearly documented deficiencies in quality of care along several dimensions (use of contraindicated oral antibiotics or 2 antibiotics when 1 would do, for example, or extremely low levels of diagnostic procedures). This supports the view that problems in quality of care are by no means confined to rare diseases or sophisticated technology but in fact are observed for widely prevalent conditions in generally healthy populations and in the most basic medical services.

This finding is in line with the work of other researchers going back many years[93] but in general the documentation of deficiencies in basic medical care has come from research designed to assess quality of care for specified populations (often with a single illness), in particular institutions (such as hospitals or clinics), or delivered by particular types of physicians. In addition, such studies have often been based on medical record abstraction or specialized (often one-time-only) data collection procedures.

The analyses reported here, by contrast, have been focused on a relatively healthy population (albeit one with special characteristics with respect to eligibility for Medicaid) and oriented toward a broad spectrum of primary care physicians. They have also been based on data derived from computerized insurance claim files, a source of medical evaluation information that will undoubtedly become more widely used in the future. Moreover, this population was a stable cohort that could be studied longitudinally. The characteristics of the episode analyses, therefore, lend substantial validity to the findings with respect to problems in quality of care, differences in levels of quality according to physician-related factors, and changes over time in medical practices.

VII. Summary and Conclusions

THIS STUDY has described patterns of ambulatory care for common respiratory illnesses and examined the effect of the New Mexico Experimental Medical Care Review Organization (EMCRO) on the quality of care for persons enrolled in the Medicaid program between September 1971 and August 1975. The first stages of the investigation used ambulatory visits as the unit of analysis and focused on the use of all injectable drugs and on IM antibiotics. The last stage used entire episodes of illness of 6 common respiratory infections (strep throat, pharyngitis, influenza, bronchitis, otitis media, upper respiratory tract infections) as the analysis unit, and focused on the use of IM and oral antibiotics, laboratory tests, and follow-up visits.

Quality of care was evaluated as a function of the characteristics of the physician giving the care; the effect of EMCRO peer review activities was assessed over time, using a quasi-experimental approach involving before and after periods and a defined population cohort. Period I referred to the time before any significant educational or review activities took place; Period II was after the major effect of the EMCRO had occurred. The cohort studied in the episode-of-care analyses comprised Medicaid eligibles enrolled in the Aid to Families with Dependent Children (AFDC) aid category continuously for all 4 years; it changed in no way except natural aging.

EMCROs can be considered prototypes of areawide peer review organizations such as Professional Standards Review Organizations (PSROs).[6,8,51] Many aspects of the PSRO program have been modeled on the organizational features of the EMCRO. The New Mexico EMCRO in particular had a comprehensive review program for both hospital and ambulatory care based upon examining claims for services billed under the Medicaid program. In addition, certain parts of its system have been suggested for adoption by PSROs, especially procedures for review of ambulatory-care claims. Thus, we believe that evaluation of the New Mexico EMCRO should provide a useful guide to assessing the degree to which such organizations might improve or at least maintain the quality of medical care, especially in federally funded programs. We emphasize, however, that generalization from New Mexico to the national PSRO program is not without its hazards, because New Mexico is basically a nonmetropolitan area whose Medicaid population is predominantly white and because the environment in which the EMCRO operated was exceptionally conducive to undertaking successful peer review.

We confined this report to issues involving quality of medical care in this Medicaid population. Equally important issues on use of inpatient hospital care, overall utilization of inpatient and outpatient services, and rising costs of care were dealt with elsewhere.[8] A few analyses were extensions of the 2-year evaluation[7] to 4 years. For the remainder, 2 major elements were added: diagnosis and entire episodes of care.

Principal Findings

1. Simple regression equations indicated that the use of all injections per Medicaid eligible declined about 75 per cent in the 4 years of the EMCRO's operation. Most of this effect was achieved within 2 years. The largest drop occurred after the institution of educational and informational efforts; additional decreases followed initiation of strict review and denial of payment for inappropriate services.

2. Changes in injection use differed markedly by type of injection. Very large declines in the use of injectable drugs were achieved for those with either potentially serious side effects or specific indications for use, including certain antibiotics (lincomycin, ampicillin, tetracycline, and short acting [SA] penicillin) and Vitamin B_{12}. Over the 4-year period, the EMCRO prevented an estimated 147,000 unnecessary injections.

3. The peer review process was based on examining use of services as a function of diagnosis. Wholesale changes in diagnoses recorded on claim forms could have made the review system ineffective. However, no *overall* shift in diagnoses to ones that might provide greater justification for those services under intensive review, such as antibiotic injections, was observed.

4. In treating common respiratory infections, the various types of physicians appeared to have different preferences for specific types of antibiotic injections irrespective of diagnosis; that is, they did not obviously select antibiotics according to diagnosis. Medical doctors (MDs) tended to prefer SA penicillin; doctors of osteopathy (DOs), especially outliers (see below), relied on lincomycin.

5. At the beginning of the study, quality of care as measured solely by the use of medically inappropriate injectable drugs varied markedly by physician characteristics. In particular, group practices provided better care than solo practitioners, MDs better than DOs, and board-certified physicians better than noncertified physicians. In addition, a small group of "outlier" physicians who had markedly poor patterns of use of injectable drugs was isolated. Twenty-two physicians (7 per cent of the 313 physicians in solo practice who gave more than 100 ambulatory visits in the first 2 years of the period under study) gave 14 per cent of the ambulatory visits but had 29 per cent of the injections billed and 41 per cent of the injections denied for medical reasons.

6. The peer review process clearly accomplished 2 clinically relevant steps. It reduced the use of antibiotic injections in the treatment of viral illnesses. It also changed the selection of an antibiotic injection (when one was needed) from a secondary (or inappropriate) one to a drug of choice, e.g., from lincomycin to long-acting (LA) penicillin.

7. Episodes of care were created for the following common respiratory infections: streptococcal sore throat (strep throat), pharyngitis/tonsillitis, bronchitis, otitis media, influenza and acute upper respiratory infection (acute URI). These episodes included ambulatory care given for the specific (or a closely related) condition and excluded extraneous care that may have been given at roughly the same time but not for the same illness.

8. Use of injectable antibiotics in the 6 respiratory illnesses studied improved markedly between the 2 periods studied. Use of injectable tetracycline, ampicillin, lincomycin, and SA penicillin dropped; use of injectable LA penicillin rose. These changes were not accompanied by any decline in quality of care as judged by criteria involving prescription drugs. No shift from inappropriate IM to inappropriate oral antibiotics was observed.

9. Physicians differed markedly in the quality of care provided, as judged by minimal criteria involving use of all antibiotic medications and use of appropriate diagnostic procedures. In general, group practices provided better care than solo providers, MDs better than DOs, board-certified physicians better than noncertified physicians, and nonoutliers better than outliers. For example, in Period I, patients with simple colds (i.e., acute URI) seen by group practices were correctly treated 78 per cent of the time, compared with 45 and 56 per cent of the time by certified MDs and DOs, and 33 and 2 per cent of the time by outlier MDs and DOs. In Period II, the figures were 81 per cent for group practices, 54 and 77 per cent for certified physi-

cians, and 55 and 32 per cent for outliers.

10. On average, quality of care for this Medicaid population was still deficient, even after the major impact of the EMCRO on injection use. For example, 56 per cent of the pharyngitis episodes were treated appropriately in Period II (76 per cent for group practices and certified MDs, 38 and 37 per cent for outlier MDs and DOs). For other respiratory diseases, the percentage of episodes judged to have been treated appropriately in Period II were as follows: strep throat, 42 per cent; otitis media in children less than 5 years old, 55 per cent; otitis media in children aged 5 to 7 years, 78 per cent; bronchitis, 81 per cent; influenza, 47 per cent; and acute URI, 51 per cent.

Use of oral tetracycline in children less than 8 years old remained unjustifiably high. Among children in this age group, about 5 per cent of acute URI or pharyngitis episodes and 16 per cent of bronchitis episodes were treated with oral tetracycline.

11. Few follow-up visits in episodes of otitis media were observed in either period. In Period I, patients in 29 per cent of all otitis media episodes had a revisit within 6 weeks after the onset of the disease; in Period II, the respective figure was 25 per cent. In Period II, at least 1 revisit was recorded for 30 per cent of otitis media episodes seen by group practices, 23 per cent of those seen by certified MDs, 20 per cent of those seen by certified DOs, 29 per cent of those seen by outlier MDs and 29 per cent of those seen by outlier DOs.

12. Use of diagnostic tests rose slightly over time for these infectious diseases, but was still extremely low in both periods. This was especially true for throat or strep cultures. On average, throat cultures were used in 11 per cent of pharyngitis episodes in Period II, and in 21 per cent of strep throat episodes (conditions for which such tests should probably be routine in at least one-half of patients). The range of use of throat cultures in the treatment of pharyngitis in Period II was from 0 per cent for outliers to 29 per cent for group practices; in the treatment of strep throat, use ranged from 1 per cent for outliers to 44 per cent for group practices.

Discussion

The EMCRO's effect on injection use and thereby on the quality of ambulatory care is unquestioned. When evaluated over time by provider characteristics, diagnoses, ambulatory visits and entire episodes of illness, sustained reductions in injection use were seen to be achieved among those classes of drugs targeted by EMCRO injection guidelines. These improvements in quality were obtained without prompting poor practices in other areas.

The timing of the considerable drop in injections use suggested that the dual approach of the EMCRO was both practical and successful. In particular, the educational activities that surrounded development and promulgation of the injection guidelines had a substantial impact; the subsequent economic sanctions in the form of denial of payments for claims for inappropriate services was a useful adjunct. The New Mexico PSRO later adopted a similar 2-committee approach to deal with problems among selected physicians; one used purely educational and informational efforts, the other more substantial review activities and sanctions (including denial of payment for services).

Remaining Quality-of-Care Problems

Other problems that these analyses identified in the quality of ambulatory care for these common infectious diseases relate to the use of oral antibiotics when they either are not indicated or are not the drug of choice, to some continuing misuse of a few injectable drugs (not necessarily antibiotics), and to a continued low level of use of pertinent diagnostic tests. The major problems in the use of oral antibiotic therapies might well be attacked first through an educational program, not payment denial. This would involve the following tasks: 1) Establish guidelines for use of prescription drugs, especially antibiotics, in much the same way as was done for injections; 2) Disseminate this information widely among New Mexico Medicaid physicians (and perhaps pharmacists); and 3) Establish review procedures that would allow monitoring of claims with these particular guidelines explicitly in mind so that physicians continuing to misuse drugs could be identified for more intensive educational efforts.

Prescription claims review with the objective of denying payment would be less likely to be effective. In the present system, if payment for a claim for a prescription were denied, the pharmacist rather than the physician giving the prescription is the one who would be penalized. To determine if a drug is medically appropriate and to assign sanctions correctly, a pharmacy claim for a prescription drug (which lacks diagnoses) would need to be matched with a physician claim (which contains diagnoses), or some other routine procedure would need to be established that placed responsibility for an inappropriate prescription on the physician rather than the pharmacist. Encouraging pharmacies to maintain drug profiles on patients and to contact prescribing physicians in the event of unjustified quantities or combinations of drugs might be attempted by PSROs, as has been tried, for example, in Utah.[9] These mechanisms could be both time-consuming and expensive, but as a general principle, sooner or later the peer review movement must find ways to make the initiating physician accountable for services that are dispensed through a third party.

As for the problem of continuing misuse of IM drugs, several steps might be considered. Renewed educational interventions might be directed at physicians clearly still disregarding EMCRO (now PSRO) guidelines, perhaps with emphasis on drugs that are almost always not indicated for the bulk of the acute conditions encountered in a Medicaid population. The New Mexico PSRO undertook activities of this sort for tetracycline and chloramphenicol as part of their ambulatory care review demonstration project.[29]

When special circumstances suggest underutilization of some services (such as throat cultures as described in this study), arguing for wholesale increases in their use would be unwise and unwarranted. Rather, for providers who exhibit, over time, patterns of submitting claims for services for illnesses in which the choice of appropriate therapy probably requires a diagnostic test (e.g., strep throat among the respiratory infections, or conditions such as anemia), but who rarely if ever do the relevant test, selective educational efforts might be undertaken. For example, one explanation for the extremely low use of throat cultures in New Mexico might be that solo practitioners in rural counties encountered difficulties getting such tests done and results returned in a timely fashion if they had to rely on outside laboratories. In such situations, a peer review organization might undertake to provide some assistance and education on how such cultures could be reliably done in the physicians' own offices. Sanctions in the form of denials of payment for the services that are billed would probably be a less effective tool for this problem, at least as a first step. Incentives in the form of higher payments for such services potentially risks prompting excessive use, which in turn raises the possibility that PSROs would have to expend additional resources to guard against overutilization.

Other Applications for the Episode Methods

Outlier Physicians. Obviously, officials must decide at some point whether physicians who disregard quality-related guidelines or who clearly provide substandard care along many dimensions should be dropped from Medicaid provider rolls. In a state such as New Mexico, such a step could have the unfortunate effect of curtailing Medicaid eligibles' access to care, for at least 2 reasons: remaining physicians may be unable or unwilling to accept additional Medicaid patients, leaving them without physician coverage, and in remote areas, there may not be any other physicians in practice. To make such a decision, some judgment must be made as to whether the totality of the care provided to Medicaid patients is sufficiently bad that, on balance, potentially more harm than good is done by allowing such providers to remain on the Medicaid rolls.

It is here that an episode approach may offer the best available analytic tool, given that outright experimentation is impossible and that outcome-based quality-of-care assessment from data based on claim forms is at best exploratory and poorly developed. Evaluating the care given for entire episodes of illness potentially gives a much clearer picture of the overall level of care delivered by questionable providers, thereby enhancing the confidence with which a decision could be made about maintaining a physician on Medicaid lists. Obviously, investigation and personal intervention on the part of peer physicians and Medicaid officials would be needed as well. The point is that episode analysis offers a more comprehensive and meaningful early-warning and screening mechanism than may have been tried in the past.

In general, our initial concept of "outliers" involved errors of commission—i.e., giving too many services (in this case medications) of questionable usefulness or relevance. Theoretically, outliers can and should also be defined in terms of errors of omission—i.e., not giving appropriate services when they are justified. Very low use of laboratory and diagnostic tests for conditions that cannot be diagnosed on the basis of signs and symptoms alone is an example.

The outliers in this study, who were identified initially on the basis of excessive use of inappropriate injections, were also found to be outliers in regard to broader diagnosis-specific criteria involving IM and oral antibiotics and appropriate use of diagnostic tests. That is, errors of both commission and omission were indeed involved. Such findings certainly seem to justify placing such physicians on 100 per cent prepayment review. If such results are replicated, PSROs may need to consider developing 2 ambulatory care review mechanisms. These would necessarily be based on different sets of incentives and sanctions that would promote the most efficient review of outlier physicians.

Chronic Conditions. Assessing care for chronic conditions is theoretically analogous to assessing acute care. The two main differences are that the episode concept must be extended over a much longer time and the appropriateness of services and medications often must be judged in the presence of specified sets of diagnoses and/or other specified services and medications, and often within some more-or-less arbitrary number of days. For example, the need for follow-up visits may be predicated on continuing use of a particular medication, or the need for one medication may be predicated on the use of a complementary drug.

PSROs can find ways to organize data bases, claims review procedures, and information collection and processing mechanisms to maximize the potential for reviewing entire episodes of care, both chronic and acute. Such steps, which would require cooperation from state Medicaid programs and fiscal intermediaries, include organizing data files on a person-by-person basis (as in New Mexico) rather than family-by-family. Another is careful monitoring of eligibility; analyses of "episodes" of care for persons who go on and off the Medicaid rolls is nearly impossible because of missing information on services that might have been received in periods of noneligibility. A third is modifying claim forms so that services can be linked directly to diagnoses or problems by the physician providing the care. The latter diminishes the need for so many algorithms to create episodes, and thus makes an episode methodology much more practical.

Long-Term Objectives of a PSRO Program

Focusing on Outliers or Typical Physicians. The question sometimes arises as to whether the chief objective of peer review organizations should be to raise the level of care given by the poorest providers up to a level approaching the average, or to attempt to improve the general level of care given by all physicians. In our view, both objectives may need to be pursued more-or-less simultaneously. The levels of quality of care provided by the outlier physicians, for example, were not tolerable for any length of time; the levels of care given by the poorest providers needed improvement even if little or no attention were paid to the care given by more accomplished physicians. On the other hand, the episode-of-illness analyses clearly indicated that all types of physicians exhibited deficiencies in handling common conditions; a reasonable inference is that less prevalent diseases are not likely to be handled at any higher level of quality. Over the long run, therefore, care delivered by the typical physician should receive explicit attention from peer review organizations.

Reducing Variation in Care. Reducing the variance in the levels of quality of care provided is an important step in terms of assuring high-quality care for entire populations, in particular for populations such as those enrolled in the Medicaid program, for whom the freedom to choose physicians may be less than in a nondisadvantaged population. Clearly, the EMCRO succeeded in reducing the variance in quality of care by markedly improving the care given by the poorest physicians, without prompting any decline in the average level of care given by other physicians.

Some observers, however, have decried just such a phenomenon, arguing for example that peer review oriented toward the process of care will decrease patients' selection of physicians, restrict patients' search among physicians for suitable care, and, most importantly, discourage physician innovation or individually tailored, nonstandard care for conditions where deviant treatment may be as or more effective.[10]

In theory, these are legitimate concerns; in practice, they may be more apparent than real. First, overly prescriptive or proscriptive peer review guidelines would of course be undesirable if applied rigidly, uniformly and unthinkingly. The essence of peer review as carried out by EMCROs or PSROs, however, is that individual cases (patient-specific or provider-specific) can be identified for review according to relatively strict criteria but that peer judgments are made on the basis of all available information. Such circumstances obviously permit "nonstandard" care to be considered acceptable in individual cases.

Second, it must be remembered that federally mandated peer review is aimed only at programs financed by public monies. Individuals who wish to acquire care that falls outside commonly accepted norms—e.g., antibiotics for a common cold, chiropractic therapy for headache, or estrogen injections for mild anxiety or depression—can exercise that option by paying for such care privately. Programs with entitlements based on age, disability or poverty, such as Medicare and Medicaid, should always be required to guard against 2-class level of care, but they should also be required to be accountable to the society at large that underwrites their expenditures. This, in turn, means that they should not be expected to subsidize services that society—in this case (but not necessarily in all cases) articulated through the professional judgment of peer physicians—deems unsuitable.

Third, our approach was to assess changes in quality according to a set of minimal criteria that gave a good deal of leeway to the physician. The reduction in variation in care reflected improvements among physicians falling below the minimum. Because such physicians delivered a substantial amount of care to the Medicaid population, this pattern of improvement in quality of care raised the probability that such eligibles eventually had greater access to better care. This type of accomplishment certainly has meaning for those who live at distances or in circumstances that preclude their seeking care from the best physicians, e.g., those who have no easy means of transportation from outlying counties to metropolitan areas or those lacking convenient and inexpensive transportation in urban areas.

Improving Ways of Using Insurance Claims Data. Review of the quality of ambulatory care may increasingly be done on insurance claims data, especially in circumstances where physician-led organizations are willing to use such information to improve care (clearly the case in New Mexico). The deficiencies in care detailed here are precisely those noted by numerous investigators in both disadvantaged and nondisadvantaged populations, often using medical record audits or other research techniques.[93] They were uncovered in a fairly straightforward way, using simple process criteria that asserted that certain services or medications should or should not be used in given instances for specific diagnoses. Care given in the Medicaid program in New Mexico is unlikely to differ in any meaningful way from that given in similar populations elsewhere, notwithstanding the earlier caveat about generalizations from the New Mexico EMCRO per se. Thus, the argument is strengthened that claim data bases, which can only grow in size and richness over the years, can and should be exploited for quality assurance purposes.

The PSRO program must identify ways to pursue its quality-of-care mandate more efficiently, especially with respect to common conditions. Given the nature of claims data bases in federally funded programs and the potential for creating computerized episodes of illness, physician and patient profiles and so forth, attention might be directed first to those problems that are uncovered through epidemiological approaches—statistical aggregation and analysis of data—rather than through isolated incidents or problems that may come to the attention of peer review organizations through patient or provider complaints, random events such as malpractice suits, or even professional judgments as to potential local problems. Mechanisms by which these claims data bases can be used in the most statistically meaningful way to pinpoint generic problems in the delivery of care must be developed, and this must be done in ways that can focus on procedures and services, characteristics of physicians, and characteristics of patients in various combinations.

Targeting on Diagnoses or Problems. The question might be raised as to whether ambulatory care review should itself be focused on selected diseases or conditions (in much the same manner that Medical Care Evaluations in the PSRO inpatient hospital program are oriented toward particular diagnoses). The conclusion from the episode-of-care analyses would seem to be that attempting to isolate particular diagnoses for intensive review may not be a particularly fruitful approach, chiefly because the deficiencies in quality of care cut across most, if not all, of the common diagnoses studied here. Thus, attempting to identify generic problems in quality of care on the basis of literature reviews, empirical research such as that reported here, and analysis of quality-related data aggregated over time may well be the preferred avenue for peer review organizations to take.

Setting Local or National Criteria. The issue of local versus national standards or criteria for quality-of-care review is particularly relevant as the national PSRO program initiates its ambulatory care review efforts in more than the present handful of demonstration projects. Experience with the EMCRO program suggests that local EMCROs tended to start from scratch in developing criteria. This may have had certain beneficial aspects, such as facilitating implementation of peer review at the local level, but it may well be inefficient in a national program, especially when criteria are unlikely to differ in marked ways. Thus, a good deal of thought should be given to developing nationally applicable guidelines for certain services, at least in cases where little or no exception could be taken to the nature or form of the recommendations. The National Council of the PSRO program might be a good starting point for such an endeavor, because of the likely ability of such a group to overcome, or at least mute, regional biases or predilections. A possible focus of their attention at first might be injectable or oral antibiotics in ambulatory care, because of the evidence nationwide as to the misuse of these drugs.[1,11,14,42,47,48,68,77,78]

Costs of Peer Review

No quality-of-care activity is without its costs. Peer review efforts in New Mexico, including both administrative and quality-of-care review, were estimated to cost about 3 per cent of the total amount spent on personal medical services,[8] and that figure is not an unreasonable estimate for an analogous nationwide program. Many of the data collection and maintenance activities that are required for quality-of-care review, however, are already subsumed within the administrative and operational tasks handled by fiscal intermediaries. Administrative and medical review tasks, therefore, take on the nature of joint products, in that the actual cost of doing either set of activities cannot, strictly speaking, be disaggregated and assigned to one or the other. Even so, some nontrivial costs over and above the purely administrative ones obviously accrue to medical review of quality of care, and several questions arise with respect to such costs.

First, what is the amount of direct and indirect costs of quality review activities? These include not only measurable operating costs, but also imputed costs of physician time if it is volunteered, potential costs of avoiding detection of substandard practices on the part of some physicians, and possible costs of substituted services to make up for revenues lost from other denied services.

Second, should improvements in quality of care be expected to lead to overall savings in medical expenditures? If so, how should such improvements be valued—as the imputed cost of poor services not given, as substitutes of a more efficient package of services for a less efficient one, or by some other metric? Other economic questions then arise, including those involving calculations of present discounted value of improvements realized in the future, the actual discount rate to use, and the time frame over which to estimate such benefits.

Third, assuming that no "savings" from quality-of-care review are realized, does society nonetheless value improving quality of care sufficiently to mandate expenditure of substantial sums of money on such activities, when such resources might be put to use in other ways, such as delivering more or different services (e.g., as might happen if deductibles and copayments in Medicare were reduced) or expanding medical facilities?

Fourth, is better quality of care more or less expensive than poorer quality of care? The conventional wisdom is that higher quality costs more; this view apparently arises in part from the belief that higher quality is related to use of more extensively trained physicians, greater reliance on more technologically advanced services, and other cost-enhancing factors such as the substitution of more sophisticated or sensitive tests for less useful ones.

Our evidence bears only slightly on most of these questions. Regarding the last, however, our results suggest that higher quality of care may not inevitably be related to higher costs of care. This conclusion is based principally on the findings, which need to be replicated elsewhere, that one major quality-of-ambulatory-care problem was overmedication—in particular, overuse of oral and injectable antibiotics. To the degree that such overmedication can be curtailed, it follows that higher quality of care should not be more costly.

The crucial assumption, of course, is that elimination of overmedication does not simultaneously prompt greater use of unnecessary services in some other arena or a rise in other services made necessary by the simple act of curtailing antibiotic use; the latter might occur if substantial increases were observed in throat cultures for patients not treated for pharyngitis or in follow-up physician visits for patients with sore throats, fever, and no clear-cut diagnosis. Moreover, even if both prescription and injectable drugs are reviewed, reducing overmedication may not lower total medical costs in any meaningful way, because of the relatively small fraction of costs that they represent (perhaps 10 per cent).[8] Finally, conclusions drawn from examples based on medication use should not be generalized extensively to other ambulatory services. Further analyses with respect to these cost/quality issues are certainly needed, especially ones based on episodes of care that are constructed to be as comprehensive and specific as possible and that include procedures and services for which costs may be high but the marginal benefit positive.

Summary

This study confirmed that peer review undertaken by a local organization of physicians substantially improved the level of quality of care provided to persons enrolled in the New Mexico Medicaid program. It demonstrated that quality assessment using claims data could be carried out through analyses based on entire episodes of care and that the quality of care for common conditions fell below acceptable levels (in particular, that oral and injectable antibiotics were often misused), that these deficiencies varied by types of physicians giving the care, and that efforts are still needed to bring care in this disadvantaged population up to acceptable levels. Generalizing extensively from this New Mexico experience is inappropriate, but if such findings were replicated in other PSRO sites and other populations (which seems entirely likely), then investments in quality assessment clearly are warranted. Society must then specify clearly how much improvement in quality of care through peer review mechanisms must take place to justify the requisite—and considerable—expenditures of public funds on such endeavors.

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APPENDIX A

Distribution of Services in Diagnosis-Specific Episodes Specified as 2, 3 or 4 Weeks in Length

TABLE 1. Distribution of Laboratory Tests by Diagnosis-Specific Episodes in Period I, Using the Same Algorithm as Used for Prescription Drugs*

Diagnosis	Number of Episodes	Laboratory Tests for this Diagnosis		Laboratory Tests for Other Infectious Disease Diagnoses		Laboratory Tests for All Other Diagnoses		Total Laboratory Tests	Laboratory Test Rate for this Diagnosis†
		Number	Per Cent	Number	Per Cent	Number	Per Cent		
Two-week episodes									
Streptococcal sore throat	368	142	90	9	6	6	4	157	.39
Otitis media	898	106	81	12	9	13	10	131	.12
Pharyngitis	2,250	316	85	27	7	30	8	373	.14
Bronchitis	1,667	177	82	16	7	22	10	215	.11
Acute URI	2,234	303	82	23	6	42	11	368	.14
Influenza	542	52	73	10	14	9	13	71	.10
Three-week episodes									
Streptococcal sore throat	316	124	86	12	8	9	6	145	.39
Otiti media	752	90	74	15	12	17	14	122	.12
Pharyngitis	1,964	279	76	39	11	48	13	366	.14
Bronchitis	1,447	160	78	29	14	15	7	204	.11
Acute URI	1,927	274	79	27	8	47	14	348	.14
Influenza	449	44	53	15	21	11	16	70	.10
Four-week episodes									
Streptococcal sore throat	263	114	86	12	9	7	5	133	.43
Otitis media	630	81	74	19	17	9	8	109	.13
Pharyngitis	1,710	245	73	37	11	54	16	336	.14
Bronchitis	1,225	135	67	39	19	28	14	202	.11
Acute URI	1,642	236	74	32	10	53	17	321	.14
Influenza	371	40	53	18	24	17	23	75	.11

* See text for description. This algorithm was used in the study.

† Number of laboratory tests for this diagnosis divided by the number of episodes.

TABLE 2. Distribution of Laboratory Tests by Diagnosis-Specific Episodes in Period I, Using the Diagnosis Coded for the Laboratory Test as the Basis for Assigning a Laboratory Test to a Diagnosis*

Diagnosis	Number of Episodes	Laboratory Tests for this Diagnosis		Laboratory Tests for Other Infectious Disease Diagnoses		Laboratory Tests for All Other Diagnoses		Total Laboratory Test	Laboratory Test Rate for this Diagnosis†
		Number	Per Cent	Number	Per Cent	Number	Per Cent		
Two-week episodes									
Streptococcal sore throat	368	123	78	13	8	21	13	157	.33
Otitis media	898	85	65	16	12	30	23	131	.09
Pharyngitis	2,250	252	68	55	15	66	18	373	.11
Bronchitis	1,667	112	52	26	12	77	36	215	.07
Acute URI	2,234	222	60	48	13	98	27	368	.10
Influenza	542	33	46	12	17	26	37	71	.06
Three-week episodes									
Streptococcal sore throat	316	114	79	14	10	17	12	145	.36
Otitis media	752	71	58	16	13	35	29	122	.09
Pharyngitis	1,964	224	61	58	16	84	23	366	.11
Bronchitis	1,447	97	48	36	18	71	35	204	.07
Acute URI	1,927	197	57	55	16	96	28	348	.10
Influenza	449	30	42	16	23	24	34	70	.07
Four-week episodes									
Streptococcal sore throat	263	105	79	15	11	13	10	133	.40
Otitis media	630	62	57	18	17	29	27	109	.10
Pharyngitis	1,710	200	60	52	15	84	25	336	.12
Bronchitis	1,225	81	40	42	21	79	39	202	.07
Acute URI	1,642	166	52	56	17	99	31	321	.10
Influenza	371	31	41	19	25	25	33	75	.08

* This form of the algorithm was not used in the construction of episodes in this study.

† Number of laboratory tests for this diagnosis divided by the number of episodes.

TABLE 3. Distribution of Selected Injections by Diagnosis-Specific Episodes in Period I

Diagnosis	Number of Episodes	Injections for this Diagnosis*		Injections for Other Infectious Diagnoses		Injections for All Other Diagnoses		Total Injections	Injection Rate for this Diagnosis†
		Number	Per Cent	Number	Per Cent	Number	Per Cent		
Two-week episodes									
Streptococcal sore throat	368	223	84	41	15	3	1	267	.61
Otitis media	898	479	92	38	7	6	1	523	.53
Pharyngitis	2,250	1,412	93	81	5	18	1	1,511	.63
Bronchitis	1,667	937	92	58	6	24	2	1,019	.56
Acute URI	2,234	988	89	102	9	19	2	1,109	.44
Influenza	542	292	92	25	8	2	1	319	.54
Three-week episodes									
Streptococcal sore throat	316	198	83	40	17	2	1	240	.63
Otitis media	752	434	89	44	9	10	2	488	.58
Pharyngitis	1,964	1,258	91	96	7	21	2	1,375	.64
Bronchitis	1,447	849	90	71	8	20	2	940	.59
Acute URI	1,927	886	85	124	12	29	3	1,039	.46
Influenza	449	252	88	34	12	1	< 0.05	287	.56
Four-week episodes									
Streptococcal sore throat	263	169	83	32	16	2	1	203	.64
Otitis media	630	368	85	60	14	6	1	434	.58
Pharyngitis	1,710	1,131	88	126	10	25	2	1,282	.66
Bronchitis	1,225	741	88	79	9	23	3	843	.60
Acute URI	1,642	783	83	126	13	32	3	941	.48
Influenza	371	215	87	32	13	1	< 0.05	248	.58

* Injections: Penicillin, Lincomycin, Ampicillin, Tetracycline, Bicillin.
† Number of injections divided by the number of episodes.

TABLE 4. Distribution of Selected Prescriptions by Diagnosis-Specific Episodes in Period I

Diagnosis	Number of Episodes	Prescriptions for this Diagnosis*		Prescriptions for Other Infectious Disease Diagnoses		Prescriptions for All Other Diagnoses		Prescriptions	Prescription Rate for this Diagnosis†
		Number	Per Cent	Number	Per Cent	Number	Per Cent		
Two-week episodes									
Streptococcal sore throat	368	211	85	27	11	9	4	247	.57
Otitis Media	898	615	93	34	5	10	2	659	.68
Pharyngitis	2,250	1,579	95	62	4	23	1	1,664	.70
Bronchitis	1,667	1,098	94	52	4	22	2	1,172	.66
Acute URI	2,234	1,163	90	97	8	27	2	1,287	.52
Influenza	542	278	90	25	8	7	2	310	.51
Three-week episodes									
Streptococcal sore throat	316	189	84	28	13	7	3	224	.60
Otitis media	752	554	91	46	8	10	2	610	.74
Pharyngitis	1,964	1,434	93	90	6	25	2	1,549	.73
Bronchitis	1,447	997	92	67	6	25	2	1,089	.69
Acute URI	1,927	1,060	87	128	10	36	3	1,224	.55
Influenza	449	237	84	37	13	7	2	281	.53
Four-week episodes									
Streptococcal sore throat	263	156	83	26	14	7	4	189	.59
Otitis media	630	480	88	56	10	10	2	546	.76
Pharyngitis	1,710	1,297	90	116	8	30	2	1,443	.76
Bronchitis	1,225	882	90	71	7	31	3	984	.72
Acute URI	1,642	953	83	146	13	45	4	1,144	.58
Influenza	371	202	80	42	17	9	4	253	.54

* Prescriptions: Ampicillin; Cephalosporin; Erythromycin; Tetracycline; Penicillin (all types); and antibiotics directed at gram-negative organisms.

† Number of prescriptions divided by the number of episodes.

TABLE 5. Distribution of Visits by Diagnosis-Specific Episodes in Period I

Diagnosis	Number of Episodes	Visits for this Diagnosis		Visits for Other Infectious Disease Diagnoses		Visits for All Other Diagnoses		Total Visits	Visit Rate for this Diagnosis*
		Number	Per Cent	Number	Per Cent	Number	Per Cent		
Two-week episodes									
Streptococcal sore throat	368	413	81	65	13	31	6	509	1.12
Otitis media	898	1,070	88	388	7	55	5	1,213	1.19
Pharyngitis	2,250	2,579	90	176	6	121	4	2,876	1.15
Bronchitis	1,667	1,840	89	123	6	105	5	2,068	1.10
Acute URI	2,234	2,527	88	194	7	150	5	2,871	1.13
Influenza	542	626	88	49	7	34	5	709	1.15
Three-week episodes									
Streptococcal sore throat	316	364	78	74	16	29	6	467	1.15
Otitis media	752	930	84	109	10	71	6	1,110	1.24
Pharyngitis	1,964	2,295	85	229	9	161	6	2,685	1.17
Bronchitis	1,447	1,646	85	162	8	136	7	1,944	1.14
Acute URI	1,927	2,241	83	253	9	212	8	2,706	1.16
Influenza	449	535	82	73	11	42	6	650	1.19
Four-week episodes									
Streptococcal sore throat	263	303	75	68	17	32	8	403	1.15
Otitis media	630	791	80	132	13	65	7	988	1.26
Pharyngitis	1,710	2,040	82	277	11	178	7	2,495	1.19
Bronchitis	1,225	1,427	82	164	9	147	8	1,738	1.16
Acute Uri	1,642	1,950	78	308	12	274	11	2,491	1.19
Influenza	371	443	78	75	13	49	9	567	1.19

* Number of visits for this diagnosis divided by the number of episodes.

APPENDIX B

Percentage Distribution of Antibiotic Medications in Diagnosis-Specific Episodes, by Type of Drug, Type of Physician and Period

The tables in Appendix B (6A–13B) are organized as follows: Each pair presented on facing pages refers to one of the diagnoses under study; the table on the left-hand page refers to Period I and the one on the right-hand page refers to Period II.

The numbers in parentheses in the headings are the numbers of episodes seen by the provider type.

The medications listed are all antibiotics. Drugs before the virgule(/) are injections administered by the physicians (or proxy). Those after the virgule are written or telephoned prescriptions filled at a pharmacy. The antibiotic entries (rows) are listed in order of the frequency with which they were observed in Period I. "Per cent of episodes" is the percentage of all episodes of the diagnosis that is accounted for by the listed injectable and oral antibiotics. Bicillin refers to the form of LA penicillin used by the providers studied.

MD indicates a doctor of medicine; DO indicates a doctor of osteopathy.

TABLE 6A. Percentage of Episodes of Streptococcal Sore Throat in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I

Injectable/Oral Drug	Total (363)	Total Groups (88)	Total MDs (106)	Outlier Noncertified MDs (53)	Other Noncertified MDs (31)	Certified MDs (20)	Total DOs (169)	Outlier Noncertified DOs (47)	Other Noncertified DOs (104)	Certified DOs (5)
No injection/no drug	24	65	21	15	25	29	5	4	6	19
Penicillin/no drug	9	3	9	5	3	29	12	27	7	—
Penicillin/ampicillin	6	—	4	7	—	4	11	4	13	39
Bicillin/no drug	6	20	5	3	6	9	—	—	—	19
Penicillin/tetracycline	6	—	11	22	—	—	6	8	7	—
Penicillin/penicillin	6	—	3	—	9	—	11	4	16	—
No injection/ampicillin	5	1	11	15	9	4	3	—	5	—
No injection/penicillin	4	1	9	—	25	9	2	—	4	—
Lincomycin/ampicillin	4	—	3	7	—	—	8	12	6	—
Lincomycin/no drug	4	—	—	—	—	—	8	22	3	—
No injection/tetracycline	3	1	6	7	6	4	2	—	3	—
Lincomycin/tetracycline	3	1	3	7	—	—	4	8	—	—
No injection/erythromycin	1	—	2	—	6	4	1	—	—	—
Lincomycin/lincomycin	1	—	—	—	—	—	2	—	2	19
Bicillin/sulfa	1	4	—	—	—	—	—	—	—	—
Bicillin/ampicillin	—	—	—	—	3	—	—	—	—	—
Bicillin/erythromycin	—	—	—	—	—	—	—	—	—	—
Bicillin/tetracycline	—	—	—	—	—	—	—	—	—	—
Bicillin/penicillin	—	—	—	—	3	—	—	—	—	—
Per cent of episodes	90	99	94	92	100	100	83	92	78	100
Per cent with no injection	42	69	52	39	74	54	22	4	30	19
Per cent with no oral drug	45	89	36	24	35	69	27	56	17	39

TABLE 6B. Percentage of Episodes of Streptococcal Sore Throat in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II

Injectable/Oral Drug	Total (461)	Total Groups (157)	Total MDs (80)	Outlier Noncertified MDs (14)	Other Noncertified MDs (37)	Certified MDs (26)	Total DOs (224)	Outlier Noncertified DOs (130)	Other Noncertified DOs (78)	Certified DOs (16)
No injection/no drugs	17	30	14	—	10	26	7	6	8	—
Penicillin/no drug	5	8	3	7	2	3	4	4	5	—
Penicillin/ampicillin	2	—	4	7	5	3	2	1	3	—
Bicillin/no drug	14	20	23	28	18	30	8	6	11	6
Penicillin/tetracycline	—	—	1	7	—	—	—	—	1	—
Penicillin/penicillin	6	—	6	14	—	7	12	6	24	—
No injection/ampicillin	5	3	4	7	5	3	7	6	7	6
No injection/penicillin	7	2	19	—	28	15	7	3	15	—
Lincomycin/ampicillin	—	—	—	—	—	—	—	—	—	—
Lincomycin/no drug	—	1	—	—	—	—	—	—	—	—
No injection/tetracycline	1	1	1	7	—	—	2	—	3	12
Lincomycin/tetracycline	—	1	—	—	—	—	—	—	—	—
No injection/erythromycin	1	2	3	—	7	—	—	—	—	—
Lincomycin/lincomycin	—	—	—	—	—	—	—	—	—	—
Bicillin/sulfa	—	—	—	—	—	—	—	—	—	—
Bicillin/ampicillin	16	13	3	7	2	3	23	29	3	68
Bicillin/erythromycin	1	—	—	—	—	—	2	3	—	—
Bicillin/tetracycline	4	3	1	—	2	—	5	9	1	—
Bicillin/penicillin	5	3	6	14	7	—	7	11	2	—
Per cent of episodes	91	92	95	100	92	96	90	90	90	94
Per cent with no injections	35	41	46	14	55	50	25	17	39	18
Per cent with no oral drugs	39	62	41	35	31	61	20	19	25	6

TABLE 7A. Percentage of Episodes of Pharyngitis in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I

Injectable/Oral Drugs	Total (2133)	Total Groups (183)	Total MDs (1105)	Outlier Noncertified MDs (374)	Other Noncertified MDs (480)	Certified MDs (228)	Total DOs (819)	Outlier Noncertified DOs (187)	Other Noncertified DOs (502)	Certified DOs (115)
No injection/no drug	17	56	19	9	25	22	6	2	9	4
Penicillin/no drug	12	10	13	20	11	9	11	11	10	13
No injection/penicillin	8	8	11	2	14	17	5	1	9	—
Penicillin/penicillin	8	1	6	4	5	10	11	12	10	17
Penicillin/ampicillin	7	—	4	10	1	1	13	3	13	28
No injection/ampicillin	6	2	8	2	10	13	6	2	7	1
Lincomycin/tetracycline	4	—	4	11	—	—	5	14	2	1
No injection/erythromycin	4	—	6	—	10	8	1	—	1	1
Penicillin/tetracycline	3	—	5	15	—	—	2	2	2	2
Lincomycin/no drug	3	—	—	1	—	—	8	22	5	—
No injection/tetracycline	3	—	3	3	3	4	3	1	3	7
Bicillin/no drug	2	12	1	—	3	1	—	—	—	—
Lincomycin/ampicillin	2	—	1	4	—	—	3	12	1	—
Lincomycin/penicillin	1	—	—	—	—	—	4	3	5	—
Tetracycline/tetracycline	1	—	—	—	—	—	2	—	1	10
Bicillin/ampicillin	—	—	—	—	—	—	—	—	—	—
Bicillin/lincomycin	—	—	—	—	—	—	—	—	—	—
Bicillin/penicillin	—	—	—	—	—	—	—	—	—	—
No injection/lincomycin	—	—	—	—	—	—	—	—	—	—
Per cent of episodes	88	93	88	87	86	89	87	90	84	90
Per cent with no injections	43	69	52	20	70	71	25	8	32	16
Per cent with no oral drugs	37	80	36	32	41	34	27	37	26	18

Table 7B. Percentage of Episodes of Pharyngitis in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II

Injectable/Oral Drugs	Total (2067)	Total Groups (267)	Total MDs (975)	Outlier Noncertified MDs (328)	Other Noncertified MDs (399)	Certified MDs (211)	Total DOs (800)	Outlier Noncertified DOs (163)	Other Noncertified DOs (543)	Certified DOs (94)
No injection/no drug	23	55	20	13	23	26	15	14	15	14
Penicillin/no drug	2	7	3	4	1	2	—	—	1	—
No injection/penicillin	17	11	22	12	25	29	12	7	15	4
Penicillin/penicillin	1	—	2	3	1	5	1	3	—	—
Penicillin/ampicillin	1	—	—	—	—	—	3	9	2	—
No injection/ampicillin	12	3	13	19	13	6	14	6	13	29
Lincomycin/tetracycline	—	—	—	—	—	—	—	—	—	—
No injection/erythromycin	5	2	7	4	8	9	4	—	6	—
Penicillin/tetracycline	—	—	—	—	—	—	—	—	—	—
Lincomycin/no drug	—	—	—	—	—	—	—	—	—	—
No injection/tetracycline	9	5	6	6	7	3	13	2	12	41
Bicillin/no drug	8	6	5	4	5	5	11	10	12	1
Lincomycin/ampicillin	—	—	—	—	—	—	—	—	—	—
Lincomycin/penicillin	—	—	—	—	—	—	—	—	—	—
Tetracycline/tetracycline	—	—	—	—	—	—	—	—	—	—
Bicillin/ampicillin	4	—	7	21	—	—	2	1	2	—
Bicillin/lincomycin	2	—	—	—	—	—	6	24	2	—
Bicillin/penicillin	1	—	1	—	2	—	2	—	3	—
No injection/lincomycin	1	—	1	—	1	2	2	1	3	4
Per cent of episodes	93	93	93	91	93	91	90	82	91	96
Per cent with no injections	71	79	74	58	83	81	65	33	70	96
Per cent with no oral drugs	35	73	29	23	31	34	28	28	30	15

TABLE 8A. Percentage of Episodes of Otitis Media in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I, Ages 4 and Younger

Injectable/Oral Drug	Total (393)	Total Groups (101)	Total MDs (166)	Outlier Noncertified MDs (38)	Other Noncertified MDs (70)	Certified MDs (56)	Total DOs (125)	Outlier Noncertified DOs (17)	Other Noncertified DOs (83)	Certified DOs (20)
No injection/no drug	19	34	18	2	22	23	8	—	10	4
No injection/ampicillin	15	9	21	7	21	30	11	—	16	—
No injection/penicillin	8	4	8	—	11	10	10	—	12	14
Bicillin/sulfa	7	28	—	—	1	—	—	—	—	—
Penicillin/ampicillin	5	—	8	23	4	5	5	—	1	25
Penicillin/no drug	4	—	6	13	5	3	6	23	2	9
No injection/erythromycin	4	2	5	2	8	3	3	—	4	4
Bicillin/no drug	4	7	4	7	1	7	—	—	—	—
Lincomycin/ampicillin	3	—	—	2	—	—	9	—	13	—
No injection/tetracycline	2	—	1	—	2	1	4	5	6	—
Penicillin/tetracycline	2	—	2	13	—	—	3	—	—	19
Lincomycin/no drug	2	—	1	5	—	—	5	17	3	—
Lincomycin/tetracycline	2	—	—	2	—	—	5	17	4	—
No injection/sulfa	1	5	—	—	—	—	—	—	—	—
Penicillin/penicillin	1	—	1	5	—	1	2	—	1	9
Lincomycin/penicillin	1	—	—	—	—	—	3	—	4	—
Ampicillin/no drug	1	—	2	5	2	—	—	—	—	—
Ampicillin/penicillin	1	—	1	—	—	5	—	—	1	—
No injection/cephalosporin	—	—	—	—	—	—	—	—	—	—
No injection/lincomycin	—	—	—	—	—	—	1	—	1	4
No injection/ampicillin-penicillin	—	—	—	—	—	—	—	—	—	—
Ampicillin/ampicillin	—	—	1	—	1	—	—	—	1	—
Bicillin/ampicillin	—	—	1	2	2	—	—	—	—	—
Penicillin/erythromycin	1	—	1	—	2	—	1	11	—	—
Per cent of episodes	88	93	90	95	90	93	84	82	86	95
Per cent with no injections	52	58	56	13	67	71	41	5	53	29
Per cent with no oral drugs	32	41	34	34	34	33	23	47	19	14

TABLE 8B. Percentage of Episodes of Otitis Media in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II, Ages 4 and Younger

Injectable/Oral Drug	Total (150)	Total Groups (41)	Total MDs (55)	Outlier Noncertified MDs (4)	Other Noncertified MDs (19)	Certified MDs (31)	Total DOs (53)	Outlier Noncertified DOs (7)	Other Noncertified DOs (41)	Certified DOs (5)
No injection/drug	23	52	12	—	5	19	11	43	4	19
No injection/ampicillin	21	11	27	25	21	32	22	—	23	39
No injection/penicillin	6	4	12	—	21	9	1	—	2	—
Bicillin/sulfa	3	7	3	—	—	6	—	—	—	—
Penicillin/ampicillin	3	2	1	—	5	—	7	28	4	—
Penicillin/no drug	—	—	1	—	—	3	—	—	—	—
No injection/erythromycin	4	2	9	25	10	6	1	—	2	—
Bicillin/no drug	5	7	3	—	—	6	5	14	4	—
Lincomycin/ampicillin	—	—	—	—	—	—	—	—	—	—
No injection/tetracycline	4	—	3	25	5	—	9	—	9	19
Penicillin/tetracycline	—	—	—	—	—	—	—	—	—	—
Lincomycin/no drug	—	—	—	—	—	—	—	—	—	—
Lincomycin/tetracycline	—	—	—	—	—	—	—	—	—	—
No injection/sulfa	1	4	—	—	—	—	—	—	—	—
Penicillin/penicillin	—	—	1	—	—	—	—	—	—	—
Lincomycin/penicillin	—	—	—	—	—	—	—	—	—	—
Ampicillin/no drug	—	—	1	—	5	—	—	—	—	—
Ampicillin/penicillin	—	—	—	—	—	—	—	—	—	—
No injection/cephalosporin	3	—	7	25	15	—	1	—	2	—
No injection/lincomycin	1	—	1	—	5	—	1	—	2	—
No injection/ampicillin-penicillin	1	—	3	—	5	3	—	—	—	—
Ampicillin/ampicillin	1	—	5	—	—	9	—	—	—	—
Bicillin/ampicillin	13	7	—	—	—	—	31	—	40	—
Penicillin/erythromycin	—	—	—	—	—	—	—	—	—	—
Per cent of episodes	95	100	98	100	100	97	94	86	98	80
Per cent with no injections	67	76	78	100	89	70	50	42	47	79
Per cent with no oral drugs	29	59	19	—	10	29	16	57	9	19

TABLE 9A. Percentage of Episodes of Otitis Media in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I, Ages 5–7

Injectable/Oral Drug	Total (156)	Total Groups (28)	Total MDs (61)	Outlier Noncertified MDs (13)	Other Noncertified MDs (21)	Certified MDs (27)	Total DOs (66)	Outlier Noncertified DOs (10)	Other Noncertified DOs (41)	Certified DOs (15)
No injection/no drug	25	67	24	7	28	29	8	—	14	—
No injection/ampicillin	10	3	14	7	9	22	10	9	11	6
No injection/penicillin	8	—	16	—	19	22	5	—	9	—
Penicillin/no drug	8	—	11	38	—	7	8	9	4	19
Penicillin/penicillin	6	—	4	—	9	—	10	—	4	33
Penicillin/ampicillin	5	—	1	7	—	—	11	9	11	13
No injection/erythromycin	5	3	4	—	14	—	5	—	7	6
Bicillin/no drug	3	10	3	7	4	—	—	—	—	—
Lincomycin/no drug	3	—	—	—	—	—	7	19	7	—
No injection/tetracycline	2	3	1	7	—	—	2	—	4	—
Bicillin/sulfa	2	10	1	—	4	—	—	—	—	—
Lincomycin/ampicillin	1	—	—	—	—	—	4	9	2	6
No injection/lincomycin	1	—	3	—	—	7	1	—	2	—
Penicillin/tetracycline	1	—	1	—	—	—	2	—	—	13
Lincomycin/erythromycin	1	—	—	—	—	—	2	9	2	—
Lincomycin/tetracycline	1	—	—	—	—	—	2	—	4	—
Ampicillin/ampicillin	1	—	1	—	—	3	1	—	2	—
Penicillin/erythromycin	—	—	1	—	4	—	—	—	—	—
Bicillin/ampicillin	—	—	—	—	—	—	—	—	—	—
Bicillin/penicillin	—	—	1	—	4	—	—	—	—	—
Per cent of episodes	92	100	95	92	100	78	90	70	93	100
Per cent with no injections	55	78	65	23	71	81	37	9	52	13
Per cent with no oral drugs	42	78	40	53	33	40	26	29	28	19

TABLE 9B. Percentage of Episodes of Otitis Media in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II, Ages 5–7

Injectable/Oral Drug	Total (106)	Total Groups (14)	Total MDs (49)	Outlier Noncertified MDs (10)	Other Noncertified MDs (16)	Certified MDs (20)	Total DOs (42)	Outlier Noncertified DOs (5)	Other Noncertified DOs (33)	Certified DOs (4)
No injection/no drug	22	50	18	9	12	29	16	—	14	50
No injection/ampicillin	10	7	10	19	6	9	11	—	14	—
No injection/penicillin	14	7	18	9	12	25	11	—	14	—
Penicillin/no drug	2	—	4	19	—	—	2	—	2	—
Penicillin/penicillin	—	—	2	—	—	4	—	—	—	—
Penicillin/ampicillin	5	—	10	9	18	4	2	—	2	—
No injection/erythromycin	6	14	6	—	12	4	4	—	5	—
Bicillin/no drug	9	21	6	9	6	—	9	19	8	—
Lincomycin/no drug	—	—	—	—	—	—	—	—	—	—
No injection/tetracycline	2	—	—	—	—	—	6	—	2	50
Bicillin/sulfa	—	—	—	—	—	—	—	—	—	—
Lincomycin/ampicillin	—	—	—	—		—	—	—	—	—
No injection/lincomycin	3	—	6	—	6	9	2	—	2	—
Penicillin/tetracycline	—	—	—	—		—	—	—	—	—
Lincomycin/erythromycin	—	—	—	—	—	—	—	—	—	—
Lincomycin/tetracycline	—	—	—	—	—	—	—	—	—	—
Ampicillin/ampicillin	—	—	2	—	—	4	—	—	—	—
Penicillin/erythromycin	1	—	4	—	12	—	—	—	—	—
Bicillin/ampicillin	13	—	6	19	—	—	25	19	29	—
Bicillin/penicillin	—	—	4	—	12	—	2	19	—	—
Per cent of episodes	95	100	98	100	100	95	95	60	100	100
Per cent with no injections	59	78	59	39	50	79	53	—	55	100
Per cent with no oral drugs	34	71	28	39	18	29	27	19	26	50

TABLE 10A. Percentage of Episodes of Bronchitis in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I

Injectable/Oral Drug	Total (1637)	Total Groups (69)	Total MDs (540)	Outlier Noncertified MDs (135)	Other Noncertified MDs (244)	Certified MDs (149)	Total DOs (1024)	Outlier Noncertified DOs (378)	Other Noncertified DOs (560)	Certified DOs (37)
No injection/no drug	21	63	33	20	37	39	12	4	15	40
No injection/tetracycline	9	5	9	1	13	10	10	5	15	—
Penicillin/no drug	8	14	13	33	5	6	5	7	4	5
No injection/penicillin	7	—	10	3	11	15	5	—	10	—
Lincomycin/tetracycline	6	—	—	1	—	—	10	18	6	—
Lincomycin/no drug	6	1	—	—	—	1	9	13	7	—
No injection/ampicillin	5	2	7	8	8	5	4	3	5	5
Lincomycin/ampicillin	4	—	—	—	—	—	7	15	1	—
Penicillin/ampicillin	2	1	2	2	3	—	3	—	4	24
Penicillin/penicillin	2	—	5	7	3	5	1	—	2	—
Penicillin/tetracycline	2	1	2	4	1	—	2	1	3	2
No injection/erythromycin	2	2	4	1	5	3	1	—	1	5
Penicillin/lincomycin	2	—	—	—	—	—	3	7	—	2
No injection/lincomycin	1	1	—	—	—	2	2	—	3	—
Lincomycin/erythromycin	1	—	—	—	—	—	2	2	1	—
Penicillin/erythromycin	1	—	1	4	—	—	1	1	—	—
Tetracycline/tetracycline	1	—	—	—	—	—	1	1	1	5
Lincomycin/lincomycin	1	—	—	—	—	—	1	3	—	—
No injection/cephalosporin	—	—	—	—	1	—	—	—	—	—
Bicillin/no drug	—	1	1	2	1	1	—	—	—	—
Per cent of episodes	90	97	91	91	94	93	89	87	86	92
Per cent with no injections	51	76	68	36	81	80	40	15	56	51
Per cent with no oral drugs	38	81	50	57	45	49	28	28	28	48

TABLE 10B. Percentage of Episodes of Bronchitis in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II

Injectable/Oral Drug	Total (1,111)	Total Groups (62)	Total MDs (380)	Outlier Noncertified MDs (88)	Other Noncertified MDs (184)	Certified MDs (99)	Total DOs (664)	Outlier Noncertified DOs (73)	Other Noncertified DOs (522)	Certified DOs (69)
No injection/no drug	35	54	41	41	47	33	29	19	28	52
No injection/tetracycline	22	16	19	8	21	25	25	5	28	21
Penicillin/no drug	1	1	2	7	—	1	1	1	1	—
No injection/penicillin	7	6	10	15	6	14	5	2	6	—
Lincomycin/tetracycline	—	—	—	—	—	—	—	—	—	—
Lincomycin/no drug	—	—	—	—	—	—	—	—	—	—
No injection/ampicillin	15	9	9	7	8	11	20	12	21	21
Lincomycin/ampicillin	—	—	—	—	—	—	—	—	—	—
Penicillin/ampicillin	—	—	—	—	—	—	—	1	—	—
Penicillin/penicillin	—	—	1	4	—	—	—	1	—	—
Penicillin/tetracycline	—	1	—	2	—	—	—	1	—	—
No injection/erythromycin	3	3	5	3	4	9	2	—	3	—
Penicillin/lincomycin	—	—	—	—	—	—	—	—	—	—
No injection/lincomycin	1	—	1	—	2	1	1	—	2	2
Lincomycin/erythromycin	—	—	—	—	—	—	—	—	—	—
Penicillin/erythromycin	—	—	—	—	—	—	—	—	—	—
Tetracycline/tetracycline	—	—	—	—	—	—	—	1	—	1
Lincomycin/lincomycin	—	—	—	1	—	—	—	1	—	—
No injection/cephalosporin	1	1	2	—	2	3	—	—	—	—
Bicillin/no drug	1	3	—	1	1	—	1	6	—	—
Per cent of episodes	91	98	93	93	95	98	88	56	92	100
Per cent with no injections	89	91	91	81	95	98	88	43	92	98
Per cent with no oral drugs	38	59	44	50	49	34	33	27	31	52

TABLE 11A. Percentage of Episodes of Influenza in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I

Injectable/Oral Drug	Total (502)	Total Groups (46)	Total MDs (186)	Outlier Noncertified MDs (59)	Other Noncertified MDs (79)	Certified MDs (44)	Total DOs (260)	Outlier Noncertified DOs (37)	Other Noncertified DOs (197)	Certified DOs (3)
No injection/no drug	29	78	36	19	45	47	14	5	17	66
Penicillin/no drug	8	4	10	26	2	—	9	5	10	—
No injection/tetracycline	8	2	12	4	16	15	7	—	9	—
No injection/ampicillin	7	—	14	11	16	13	3	—	2	33
Lincomycin/no drug	7	—	1	1	—	2	12	51	6	—
No injection/penicillin	4	2	7	4	11	4	2	—	2	—
Lincomycin/tetracycline	3	—	1	3	—	—	6	8	5	—
Tetracycline/tetracycline	3	—	—	—	—	—	6	2	7	—
Tetracycline/no drug	2	—	—	—	—	—	5	2	6	—
No injection/erythromycin	2	—	2	4	—	4	2	—	3	—
Penicillin/ampicillin	2	—	3	9	—	—	1	—	1	—
Penicillin/tetracycline	1	—	2	4	2	—	1	—	1	—
Ampicillin/ampicillin	1	—	—	—	—	—	2	—	—	—
Bicillin/no drug	1	2	2	3	—	4	—	—	—	—
Penicillin/penicillin	1	—	1	1	—	4	1	—	—	—
No injection/lincomycin	1	—	—	—	—	—	2	—	2	—
Lincomycin/erythromycin	1	—	—	—	—	—	2	5	—	—
Lincomycin/penicillin	1	—	—	—	—	—	2	5	1	—
Lincomycin/lincomycin	1	—	—	—	—	—	2	8	1	—
No injection/cephalosporin	—	—	—	1	—	—	—	—	—	—
Per cent of episodes	91	89	96	98	95	98	87	95	82	100
Per cent with no injections	55	84	76	47	93	88	34	5	41	100
Per cent with no oral drugs	50	84	50	50	48	54	42	64	41	66

TABLE 11B. Percentage of Episodes of Influenza in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II

Injectable/Oral Drug	Total (305)	Total Groups (38)	Total MDs (151)	Outlier Noncertified MDs (71)	Other Noncertified MDs (42)	Certified MDs (35)	Total DOs (114)	Outlier Noncertified DOs (17)	Other Noncertified DOs (91)	Certified DOs (7)
No injection/no drug	47	60	50	43	50	61	37	11	42	42
Penicillin/no drug	2	2	—	1	—	—	6	23	3	—
No injection/tetracycline	13	5	9	5	16	5	21	17	18	57
No injection/ampicillin	9	13	9	9	11	8	7	23	4	—
Lincomycin/no drug	—	—	—	—	—	—	1	—	2	—
No injection/penicillin	7	2	12	14	11	11	3	—	4	—
Lincomycin/tetracycline	—	2	—	—	—	—	—	—	1	—
Tetracycline/tetracycline	—	—	—	—	—	—	1	11	—	—
Tretracycline/no drug	—	—	—	—	—	—	1	—	2	—
No injection/erythromycin	5	7	7	11	2	5	1	—	2	—
Penicillin/ampicillin	1	—	—	1	—	—	2	11	1	—
Penicillin/tetracycline	—	—	—	—	2	—	—	—	—	—
Ampicillin/ampicillin	—	—	—	—	—	—	—	—	—	—
Bicillin/no drug	1	2	1	1	4	—	—	—	—	—
Penicillin/penicillin	—	—	—	—	—	—	—	—	—	—
No injection/lincomycin	—	—	—	—	—	—	—	—	—	—
Lincomycin/erythromycin	—	—	—	—	—	—	—	—	—	—
Lincomycin/penicillin	—	—	—	—	—	—	—	—	—	—
Lincomycin/lincomycin	—	2	—	—	—	—	—	—	—	—
No injection/cephalosporin	2	—	—	—	—	—	6	—	7	—
Per cent of episodes	90	100	91	89	100	92	91	100	90	100
Per cent with no injections	86	89	92	87	92	100	78	52	81	100
Per cent with no oral drugs	52	65	52	46	54	61	48	35	51	42

Table 12A. Percentage of Episodes of Acute URI in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period I

Injectable/Oral Drug	Total (2106)	Total Groups (325)	Total MDs (826)	Outlier Noncertified MDs (129)	Other Noncertified MDs (388)	Certified MDs (258)	Total DOs (933)	Outlier Noncertified DOs (234)	Other Noncertified DOs (664)	Certified DOs (30)
No injection/no drug	36	78	43	33	47	45	14	2	16	56
Penicillin/no drug	9	3	6	15	4	1	14	32	8	6
No injection/ampicillin	8	3	12	4	16	12	5	—	7	3
Penicillin/penicillin	7	1	2	—	2	2	13	21	12	—
No injection/tetracycline	6	—	8	3	7	12	7	1	8	23
No injection/penicillin	5	1	6	2	5	10	6	4	8	—
No injection/erythromycin	3	—	5	12	5	3	2	—	3	—
Penicillin/ampicillin	3	—	2	6	3	—	5	2	6	—
Penicillin/tetracycline	2	—	2	7	—	—	4	7	3	—
Lincomycin/no drug	2	—	—	—	—	—	4	11	2	—
Penicillin/erythromycin	1	—	—	2	—	—	2	3	2	—
Bicillin/no drug	1	5	2	—	2	4	1	—	—	—
No injection/cephalosporin	—	—	—	—	—	—	—	—	—	—
No injection/lincomycin	—	—	—	—	—	—	—	—	—	—
Per cent of episodes	89	93	92	88	95	93	85	88	80	90
Per cent with no injections	62	87	78	58	83	88	38	10	45	83
Per cent with no oral drugs	51	86	54	50	55	50	36	47	30	69

TABLE 12B. Percentage of Episodes of Acute URI in Which Injectable and Oral Antibiotics Were Used, by Provider Type, Period II

Injectable/Oral Drug	Total (1363)	Total Groups (170)	Total MDs (670)	Outlier Noncertified MDs (159)	Other Noncertified MDs (347)	Certified MDs (130)	Total DOs (482)	Outlier Noncertified DOs (121)	Other Noncertified DOs (352)	Certified DOs (9)
No injection/no drug	51	81	52	55	50	54	38	32	39	77
Penicillin/no drug	2	5	1	5	—	—	—	3	—	—
No injection/ampicillin	8	—	8	—	12	5	12	21	10	—
Penicillin/penicillin	—	—	—	—	—	—	—	2	—	—
No injection/tetracycline	9	2	9	6	11	8	11	3	13	22
No injection/penicillin	11	2	13	7	15	12	12	6	14	—
No injection/erythromycin	7	1	7	14	3	10	9	—	12	—
Penicillin/ampicillin	1	—	—	3	—	—	4	17	—	—
Penicillin/tetracycline	—	—	—	—	—	—	—	2	—	—
Lincomycin/no drug	—	—	—	—	—	—	—	—	—	—
Penicillin/erythromycin	—	—	—	—	—	—	—	—	—	—
Bicillin/no drug	1	2	1	1	—	2	—	1	—	—
No injection/cephalosporin	1	—	—	—	—	—	—	—	3	—
No injection/lincomycin	1	—	1	1	—	3	3	3	3	—
Per cent of episodes	96	97	96	96	93	96	92	93	97	100
Per cent with no injections	92	89	94	90	95	96	91	68	98	100
Per cent with no oral drugs	55	91	55	63	52	57	39	38	39	77

TABLE 13A. Percentage of Episodes of Pharyngitis in Which Injectable and Oral Antibiotics Were Used, by Specialty Type, Period I

	MDs					DOs				
Injectable/Oral Drug	Internal Medicine (77)	Pediatrics (165)	General Practice (733)	Obstetrics/ Gynecology (9)	Surgery (117)	Internal Medicine (6)	Pediatrics (15)	General Practice (558)	Obstetrics/ Gynecology (118)	Surgery (112)
No injection/no drug	24	23	15	11	29	66	7	5	8	3
Penicillin/no drug	10	1	18	—	8	—	—	12	14	2
No injection/penicillin	14	27	8	22	1	—	—	5	3	11
Penicillin/penicillin	5	2	8	—	—	—	—	7	40	5
Penicillin/ampicillin	—	—	6	—	3	—	—	15	11	7
No injection/ampicillin	11	12	6	33	11	—	—	5	3	16
Lincomycin/tetracycline	2	—	6	—	—	33	—	6	—	6
No injection/erythromycin	1	12	4	22	18	—	—	—	—	4
Penicillin/tetracycline	11	—	6	—	3	—	—	3	—	—
Lincomycin/no drug	2	—	—	—	—	—	47	8	—	8
No injection/tetracycline	5	1	3	—	5	—	—	3	5	1
Bicillin/no drug	5	4	1	—	—	—	—	—	—	—
Lincomycin/ampicillin	—	—	2	—	—	—	—	4	—	6
Lincomycin/penicillin	—	—	—	—	—	—	40	2	—	10
Tetracycline/tetracycline	—	—	—	—	—	—	—	2	3	—
Bicillin/ampicillin	1	—	—	—	—	—	—	—	—	—
Bicillin/lincomycin	—	—	—	—	—	—	—	—	—	—
Bicillin/penicillin	—	1	—	11	—	—	—	—	—	—
No injection/lincomycin	—	—	—	—	3	—	—	—	—	1
Per cent of episodes	96	87	87	100	87	100	93	85	91	87
Per cent with no injections	57	85	40	88	76	66	6	22	21	42
Per cent with no oral drugs	42	30	36	11	39	66	53	28	24	14
Per cent with appropriate care	49	68	36	55	48	66	6	17	51	23

TABLE 13B. Percentage of Episodes of Pharyngitis in Which Injectable and Oral Antibiotics Were Used, by Specialty Type, Period II

	MDs					DOs				
Injectable/Oral Drug	Internal Medicine (111)	Pediatrics (151)	General Practice (622)	Obstetrics/ Gynecology (—)	Surgery (83)	Internal Medicine (5)	Pediatrics (19)	General Practice (553)	Obstetrics/ Gynecology (185)	Surgery (32)
No injection/no drug	14	24	18	—	31	60	32	16	8	19
Penicillin/no drug	4	1	3	—	1	—	—	1	—	—
No injection/penicillin	27	26	22	—	13	—	32	12	11	22
Penicillin/penicillin	9	1	2	—	1	—	—	1	—	—
Penicillin/ampicillin	—	—	—	—	—	—	—	1	8	—
No injection/ampicillin	6	18	14	—	3	—	11	18	2	9
Lincomycin/tetracycline	1	—	—	—	—	—	—	—	—	—
No injection/erythromycin	2	3	7	—	21	—	—	3	5	6
Penicillin/tetracycline	—	—	—	—	—	—	—	—	—	—
Lincomycin/no drug	—	—	—	—	—	—	5	—	—	—
No injection/tetracycline	12	1	6	—	9	20	16	13	12	19
Bicillin/no drug	8	5	5	—	2	—	—	12	8	16
Lincomycin/ampicillin	—	—	—	—	—	—	—	—	—	—
Lincomycin/penicillin	—	—	—	—	—	—	—	—	—	—
Tetracycline/tetracycline	—	—	—	—	—	—	—	—	—	—
Bicillin/ampicillin	—	—	12	—	—	—	—	3	—	—
Bicillin/lincomycin	—	—	—	—	—	—	—	1	21	—
Bicillin/penicillin	2	3	—	—	2	—	—	3	1	—
No injection/lincomycin	—	4	—	—	3	20	—	2	3	—
Per cent of episodes	91	91	92	—	90	100	95	94	83	91
Per cent with no injections	68	84	70	—	87	100	89	71	46	81
Per cent with no oral drugs	27	31	27	—	34	59	36	30	17	34
Per cent with appropriate care	60	59	54	—	68	78	62	44	32	60

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